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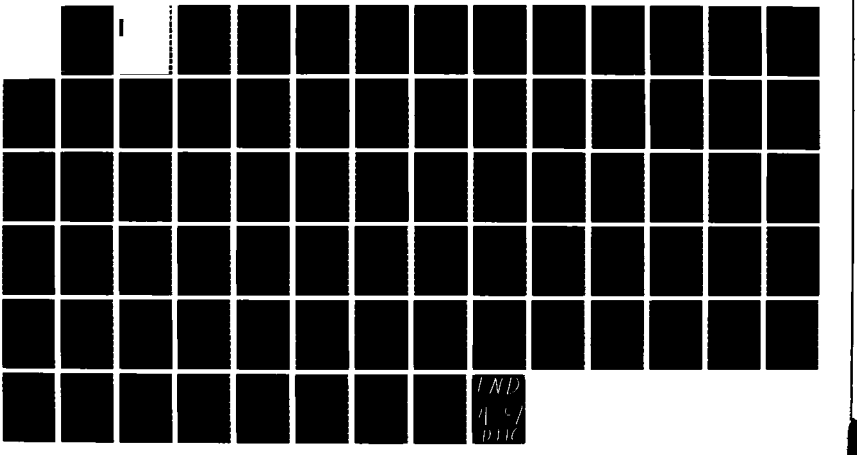

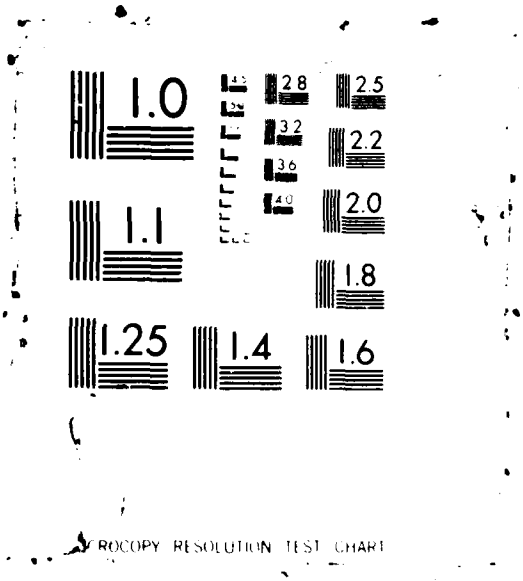
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ROCOPY RESOLUTION TEST CHART

APRO 85-06

FINAL

COMPETITION DECISION-ASSIST PACKAGE FOR THE MICROCOMPUTER

by

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and

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Information and data contained in this document are based on input available at the time of preparation. This document represents the view of the authors and should not be construed to represent the official position of the United States Army.

The pronouns "he", "his", and "him", when used in this publication, represent both the masculine and feminine genders unless otherwise specifically stated.

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EXECUTIVE SUMMARY

A. BACKGROUND. Now more than ever Project Managers must assess the extent to which their system ought to be competed. While current guidance, including the current AMC Pamphlet 715-9, the Competition Decision-Assist Package, is useful in analyzing the competition decision, a need exists for an improved automated process for providing decision support information to managers.

B. STUDY OBJECTIVE. The objective of this study was to develop, test, and effectively operate a transportable microcomputer system version of the Competition Decision-Assist Package (CDAP) in order to enhance its versatility in the field.

C. SUMMARY. The Competition Decision-Assist Package for the Microcomputer is a microcomputer FORTRAN version of CDAP that operates on an IBM Personal Computer and compatibles. It performs just as the CDAP does, but it is more easily transported to the field via floppy disk.

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SECTION I

INTRODUCTION

A. BACKGROUND

With the enactment of the Competition in Contracting Act (CICA) in 1984, competition is expected in the production of major weapon systems. Now more than ever Project Managers (PM) must assess the extent to which their system ought to be competed. In APRO 82-08, Competition Decision-Assist Package (CDAP), the Army Procurement Reseach Office (APRO) developed a decision-assist package consisting of a computer program and a guidance document to assist the PM's analytical staff in evaluating the likely cost effects and non-cost effects of competitive acquisition strategies. In APRO 84-09, CDAP-Enhanced, the Army Procurement Research Office expanded the competition analysis capability and improved the output presentations of the model.

While current guidance is helpful in analyzing the competition decision, a need exists for an improved automated process for providing decision support information to managers. The model should provide a general framework for analysis that can be readily modified to accommodate the acquisition peculiarities of a particular system under consideration. Further, most of the analytical information needs to be available to the manager/decisionmaker in a form which will readily enable him to assess significant total cost differences between alternatives. In order to better serve the needs of a manager/decisionmaker, a transportable and

automated CDAP tool must be available to the PM's analysts. Recent hardware advances and integrated state-of-the-art software systems provide an environment which lends itself to the transformation of CDAP from a mainframe computer mode to a microcomputer mode.

B. OBJECTIVE

The objective of this effort was to develop, test, and effectively operate a transportable microcomputer system version of the CDAP model in order to enhance its versatility in the field. It was the intent of this project to provide a timely solution to the problem of transportability of CDAP to the field.

C. APPROACH

The study approach to provide a Competition Decision-Assist Package for the Microcomputer (CDAPM) was as follows:

1. Obtain a "state-of-the-art" transportable microcomputer for use within APRO.

2. Download the mainframe version of CDAP and tailor the FORTRAN coding as required to ensure the precise transition of the CDAP model from the mainframe computer to the microcomputer.

3. Test the microcomputer version(s) for accuracy and structural integrity.

4. Develop guidance for the microcomputer version of CDAP.

5. Recommend pamphlet changes as appropriate to provide adequate guidance to users.

SECTION II

CDAP FOR THE MICROCOMPUTER

A. COMPETITION ANALYSIS

It is generally accepted that competition can reduce costs, improve quality and performance, and enhance the industrial base; and this has usually been the case. In order to maximize the benefits from competition, a thorough analysis should be made of each system to structure the appropriate competition strategy. This analysis typically focuses on both the qualitative and quantitative factors impacting the competition and further breaks the quantitative cost factors into non-recurring investment costs and recurring unit costs.

AMC Pam 715-9 describes these factors and offers the CDAP as a means to analyze primarily the recurring cost savings. The economic analysis model selected for the approved CDAP guidance is based upon production improvement (learning curve) theory that involves making a comparison on non-recurring cost (i.e., Government and contractor investment) and recurring cost savings. Although this approach requires experienced procurement judgement, it is reasonably quantitative and repetitive in nature.

To increase the acceptance and use in the field, some enhancements to the current CDAP were required. These include improved output presentation formats, expanded analysis capability, and increased "transportability" of the package to the field. It is the intent of this study to meet the transportability requirements. Planned improvements for CDAP in

the future include incorporating the non-recurring investment cost analysis directly into the CDAP. Currently it is done separately to supplement CDAP and provide a complete analysis.

B. COMPETITON DECISION-ASSIST PACKAGE FOR THE MICROCOMPUTER

The Competition Decision-Assist Package for the Microcomputer (CDAPM) was written in FORTRAN for the IBM PC and compatible computers. It is virtually the same program as the mainframe Competition Decision-Assist Package--Enhanced (CDAP-E, APRO report 84-09 by V. Gail Lankford). Some changes were made to the way CDAP-E handles output from the user and the way it displays its results. Other changes, invisible to the user, had to be made to adapt CDAP-E to the software environment of the PC.

SECTION III

USING CDAPM

A. WHAT CDAPM NEEDS

CDAPM absolutely requires the following items:

1. An IBM PC or compatible computer with 128K of user memory and one double-sided, double-density 5.25 inch diskette drive.
2. DOS for that PC: 2.0 or a higher version.
3. This document.
4. The diskette accompanying this document.

Recommended for CDAPM, but NOT required:

1. A printer.
2. An additional disk drive (hard disk is best).
3. A math coprocessor chip (Intel 8087 or similar).

B. PROTECTING CDAPM AND DATA

Users MUST NOT use the distribution diskette to run CDAPM.

The file CDAPM.EXE should be copied from the distribution onto a hard disk or a dedicated CDAPM execution diskette. The distribution should then be put in a safe place. If two backups are desired, the distribution diskette can be duplicated with the DOS commands DISKCOPY or COPY; CDAPM is not copy-protected.

CDAPM data files should be backed up before every CDAPM session.

On the distribution diskette is the original FORTRAN source file for CDAPM. All users are free to modify CDAPM in any fashion they desire, but APRO requests that all modified versions of CDAPM be documented to prevent confusion with APRO's version.

C. MAKING CDAPM GO

The computer should be up and running, and the DOS command prompt should be on the screen.

The default drive and directory should be set to the place where the data files will be stored.

If the file CDAPM.EXE is not there, the PATH must be set to include the place where CDAPM.EXE exists.

CDAPM is started by typing CDAPM and a carriage return.

Appendix A of this document contains step-by-step instructions on how to make CDAPM perform a given analysis.

APPENDIX A

CDAPM USER'S GUIDE

(This appendix is adapted from APRO Report 84-09, Competition Decision-Assist Package Enhanced, by V. Gail Lankford.)

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APPENDIX A

CDAPM USERS' GUIDE

A. MODEL OVERVIEW.

This interactive computer program has been designed to calculate estimates of recurring costs associated with two producers involved in a competitive unit production effort. The concepts employed in this program are those described in Chapter III of APRO 82-08, Competition Decision-Assist Package. The model is based on learning curve or cost-improvement curve theory, which states that a relationship exists between production quantity and unit price such that, as the quantity produced doubles, the unit price will be a fixed percentage less than the unit price prior to the doubling. For example, if a 95% learning curve is being observed, the cost of the 200th item will be 95% of the cost of the 100th item. According to this theory, total recurring cost (c) can be computed as the sum of these declining unit costs, and represented by the following function:

$$c = \sum_{q=q_1}^{q_2} aq^b$$

where a represents first unit cost, b is the rate of cost improvement, and the production quantity extends from unit q_1 to q_2.

Certain modifications to this fundamental expression are necessary to accomodate any shifts in unit price and/or rotation of the cost-improvement curve which are attributable to the introduction of competition into the process. A shift in unit price is represented by an equivalent shift in the first unit cost. A change in the cost-improvement curve is modeled by

adjusting the expression exponent, b, an appropriate amount. Also, since it is common for the analysis to consider production efforts spanning several delivery years, it may be desirable to include the time value of money in the analysis. This can be accomplished by multiplying each year's production cost by an appropriate discount factor. Thus, the basic relationship becomes for year i:

$$c_i = \alpha_i (1-p_i) \sum_{q=q_{i-1}+1}^{q_i} a_q^{(b-\sigma_i)}$$

where α_i represents the discount factor for year i, q_i represents the production experience of a producer at the end of year i, p_i is the percent reduction in unit cost at year i due to a shift in unit price and σ_i is the relative change in the cost-improvement rate at year i due to rotation.

Any combination of adjustments can be applied for any production year, as appropriate. When no adjustments are made, the expression reverts to its original form.

The total program recurring cost can be computed by evaluating the given expression for each production year and summing the results. The total cost, C, for n years is represented by:

$$C = \sum_{i=1}^{n} \alpha_i (1-p_i) \sum_{q=q_{i-1}+1}^{q_i} a_q^{(b-\sigma_i)}$$

Costs may be computed in constant or in discounted dollars at the option of the user.

The result of the effort to compute the total program recurring costs, based on the cost effects of competition, depends greatly on the accuracy of

the input data which are developed by the user and provided interactively to the model. If all the parameter values were known with certainty, the alternative strategy costs could be easily computed. However, when the parameter values are not known with certainty, as is often the case, a range of values must be judgementally assigned to each data element, with the range reflecting the general level of uncertainty. In this CDAPM model, each factor of the basic cost relationship is treated as a triangular distribution of values with minimum, most likely, and maximum magnitudes. The model uses Monte Carlo techniques, randomly sampling from these distributions for each simulation. By repeating the process many times, a range of probable costs is developed.

Based on the simulation, the program output provides both the mean and median estimates of the total program recurring costs, minimum and maximum probable costs, the range of those costs, and the fourth-spread values: the values which bound the middle fifty percent of the simulated results. For multiple production periods, the cost of each period is given for each producer along with an aggregate lot cost. The program will also determine which of the two producers is most likely to win a split buy award and will display the relative win percentage. Finally, options also allow a cumulative probability versus total program recurring cost and probability density plots to be displayed.

B. ASSUMPTIONS/CONSTRAINTS.

It is well recognized that program logic influences model results and can introduce biases into those results. Assumptions inherent in the model logic

should be known to the user so he can better assess the appropriateness of the model as a tool for his analysis. The following assumptions and constraints are embedded within the algorithms and code of CDAP and CDAPM:

1. The first producer whose data is input to the model is considered the "Prime".

2. The model is constrained to consider not more than two competitors in a simulation.

3. "All or nothing" lot awards go the "Prime" until there is a split award. Thereafter, "all or nothing" lots are awarded to the producer with the lowest cumulative average unit cost prior to that lot.

4. On split awards, the major portion of the lot goes to the producer with the lowest cumulative average unit cost prior to that lot being awarded. Exception: If the first lot in the simulation is a split award, the major portion of the lot is awarded to the "Prime."

5. If a lot is split into two equal parts for award, it is assumed that the two producers are fully competitive and would bid the same price. The model sets the "Second Source" lot cost equal to that computed for the "Prime" for this lot.

6. For lots which are split into two equal parts, the Prime split win percentage displayed in the output result will be 100%. This statistic is meaningless in this instance, as no computation is made in the model to determine which producer would have won the major portion of the lot if the lot had not been split equally. The user can determine the percentage of time each producer would win the major portion by splitting the lot unequally and running a sensitivity analysis.

7. When a range of values is input to the model for a data element, a triangular distribution is assumed and values are computed as needed using a Monte Carlo sampling technique.

8. Ten percent (10%) discount factors are used when the option to discount is selected.

9. The magnitude of the analysis is limited to twenty-five (25) production lots.

10. The simulation is limited to 5000 iterations.

C. EXECUTION OF COMPUTER PROGRAM.

The program has been divided into three basic operational modes: data file create, data file modification, and simulate. Each of these modes are described in the sections which follow and example data files are given. An example session for each mode is also provided.

1. Data File Create Mode.

This program mode allows data files to be created interactively by following prompts given at the user's terminal. A number of the input parameters require three values to be entered. If conditions do not warrant a range of values, the same value is entered for each of the three required entries. The following information is requested:

a. Desired file name.

When a proposed file name is entered, its existence is checked to determine if another file with the entered name already exists. If the name does not already exist, it is accepted for use with the file being created. If the name already exists in the user's directory, the program

will ask for another name. This is done to prevent over writing an existing file.

b. Number of production lots to be evaluated. (Limited to 25)

c. First unit cost for prime producer. (minimum, most likely, maximum)

d. First unit cost for the second source. (minimum, most likely, maximum)

e. Prime producer performance curve slope. (minimum, most likely, maximum) for example: .88, .92, .95

f. Second source performance curve slope. (minimum, most likely, maximum)

g. Individual lot data.

(1) Major split quantity/minor split quantity. If it is desired to establish a sole source producer baseline, all lot quantity is entered in the major split value. The output will then only reflect results for the prime producer under sole source conditions. Computation of lot costs for split buy awards are based on a major/minor quantity award to each producer. For a given cycle of the simulation when unequal values have been entered for the major and minor split quantities, the program awards the major split quantity to the producer having the lowest unit price prior to the given lot (adjusted for any shifts). This approach to dealing with split awards may not be appropriate in all cases. An alternate method is available within the program. By entering equal values for the major and minor split quantities, a "composite" performance approach is invoked. The total lot will be split evenly between the two

producers, and the model will assign equal lot costs for each producer. This simulates both producers behaving in exactly the same manner.

(2) Prime producer competition shift percentage (minimum, most likely, maximum)/second source competition shift percentage (minimum, most likely, maximum). Shifts are entered relative to a base of 1.0. If no shift is expected to take place, enter 1.0. If, due to competition, you expect the prime producer to lower his unit price by 8 percent, that would be entered as .92 (1 - .08). If the range is expected to be a 5 to 12 percent decrease, then the values entered would be .88, .92 and .95 (in each case modifying the base of 1.0 by the percent shift). The model can also handle an increase in unit price. A 2 percent increase would be entered as 1.02.

(3) Prime producer curve competition rotation (minimum, most likely, maximum)/second source curve competition rotation (minimum, most likely, maximum). Entry of performance curve rotation values is based on slope percentage points. If the basic curve slope had been entered as .93 and is expected to reach a value of .91 after competition, the rotation entry would be .02 to indicate a downward rotation. Upward rotations may be indicated by using negative input values. An example of inputs for a downward rotation is .01, .02, .03.

To maximize ease of data review, appropriate headings are stored along with the data entries. It is thus possible to quickly review the contents of individual files for accuracy without utilizing the available file modification mode, if desired.

2. File Modify Mode.

Changes to existing data files can easily be made using the modify

mode. When this mode is entered, the name of the data file to be modified is requested. All information in the file is then displayed along with a reference number. Entry of the apropriate reference number causes the data entry prompt for the affected element to be displayed.

While in this mode it is possible to extend the number of lots to be evaluated by simply changing the entry for number of lots. When that value is increased the program will automatically display the lot data prompts for the new lot or lots. It should also be noted that if one entry for a given lot is to be modified, all data entry prompts for that lot will be given. The data elements that remain unchanged are simply reentered.

3. Simulation Mode.

When the simulation mode is entered, the user is queried by prompts for the information necesary to execute the simulation. The name of the appropriate data file for the simulation is requested and verified for its existence. Once the proper data file has been established the user is asked for an arbitrary whole number between 1 and 999,999, and then whether a cumulative probability plot and a probability density plot are desired. The desired number of simulation cycles must be input (5000 is the maximum allowed). Choosing the same arbitrary whole number and the same number of cycles on two different runs of CDAPM will cause CDAPM to produce identical results on the two runs. Then the user selects whether the option to discount is to be implemented. If a negative response is given to this prompt, output results will be in constant base year dollars. A positive response will cause the program to request the lot number that discounting should begin. When discounting is selected the output will be annotated accordingly. Discounting in this program is based on yearly midpoints.

Basic program output consists of a presentation of the total average cost and other statistical indicators of central tendency and spread, along with individual lot average costs. Basic output also displays the individual input parameters derived from the specified file. Display of the probability plots was made optional to minimize printing time if that information is not actually needed for a given analysis.

4. Sensitivity Analysis.

The analyst is encouraged to check the sensitivity of the simulation output results to input parameters of concern. This is readily accomplished by modifying one parameter in the input file, rerunning the simulation, and comparing the new results with those of the initial run. For this comparison purpose the simulation should be run for the same number of iterations and same arbitrary whole number each time. Although Monte Carlo techniques are used in the simulation, this will cause no problem when comparing the results of the sensitivity analysis with the baseline, so long as both runs are performed on the same ADP system.

D. EXAMPLE INPUT DATA FILES.

1. Example 1.

This example sets up data for a sole source baseline. The production period covers four years. Note that all lot quantities are placed in the major split category, and that no performance curve shifts or rotations are entered.

```
PRIME FIRST UNIT COST---MIN)  80000.   MOST LIKELY) 100000.   MAX) 127000.
SECOND SOURCE-----------MIN)      0.   MOST LIKELY)      0.   MAX)      0.
PRIME PCURVE SLOPE------MIN)  .910     MOST LIKELY)  .930     MAX)  .950
SECOND SOURCE-----------MIN)1.000      MOST LIKELY)1.000      MAX)1.000
```

LOT #	LOT QUAN	SHIFT FACTOR PRIME			SHIFT FACTOR SECOND SOURCE			ROTATION FACT PRIME			ROTATION FACT SECOND SOURCE		
	MAX	MIN	M.L.	MAX	MIN	M.L.	MAX	MIN	M.L.	MAX	MIN	M.L.	MAX
1	1000.	0.	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00
2	1800.	0.	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00
3	2500.	0.	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00
4	3000.	0.	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00

Figure A-1. Example 1 Input Data File

2. Example 2.

This example sets up a file for a six year production program where a split buy competition is introduced in the first year with a buy-out in the fifth and sixth years. Note that shift factors are introduced for both producers in the second year, and both shift and rotation are introduced in the third year as the producers respond to competitive pressures.

```
PRIME FIRST UNIT COST---MIN) 100000.   MOST LIKELY) 140000.   MAX) 200000.
SECOND SOURCE-----------MIN)  90000.   MOST LIKELY) 140000.   MAX) 210000.
PRIME PCURVE SLOPE------MIN)  .870     MOST LIKELY)  .940     MAX)  .980
SECOND SOURCE-----------MIN)  .850     MOST LIKELY)  .940     MAX)  .970
```

LOT #	LOT QUAN	SHIFT FACTOR PRIME			SHIFT FACTOR SECOND SOURCE			ROTATION FACT PRIME			ROTATION FACT SECOND SOURCE		
	MAX	MIN	M.L.	MAX	MIN	M.L.	MAX	MIN	M.L.	MAX	MIN	M.L.	MAX
1	500.	300.	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00
2	1500.	500.	.94	.96	.98	.95	.98	1.00	.00	.00	.00	.00	.00	.00
3	2500.	1200.	.96	.98	1.00	.94	.96	.98	.02	.04	.06	.01	.03	.04
4	4000.	2000.	1.00	1.00	1.00	.95	.97	1.00	.00	.00	.00	.02	.04	.05
5	4000.	0.	1.00	1.00	1.00	.96	.98	1.00	.00	.00	.00	.00	.00	.00
6	4000.	0.	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00

Figure A-2. Example 2 Input Data File

E. PROGRAM EXECUTION EXAMPLES.

FILE CREATE MODE EXAMPLE SESSION

```
The following program modes are available:

    1.  Create a new data file (C)

    2.  Modify an existing data file (M)

    3.  Run using an existing data file (R)
Enter the letter shown in (  ) that corresponds to the desired mode
C

What is the data file name?
Testfile

How many lots are there in this data set?
2

First unit cost for prime
Minimum:  100000

Most likely:  120000

Maximum:  170000

Second source first unit cost
Minimum:  90000

Most likely:  115000

Maximum:  170000

Prime performance curve slope (.XXX)
Minimum:  .88

Most likely:  .95

Maximum:  .95

Second source performance curve slope (.XXX)
Minimum:  .86

Most likely:  .89

Maximum:  .95
```

Data for lot # 1
Major split quantity 600

Minor split quantity 300

Prime shift factor (.XXX)
Minimum: .90

Most likely: .95

Maximum: .99

Second source shift factor (.XXX)
Minimum: .88

Most likely: .93

Maximum: .98

Prime rotation factor (.XXX)
Minimum: .01

Most likely: .02

Maximum: .03

Second source rotation factor (.XXX)
Minimum: .01

Most likely: .02

Maximum: .03

Data for lot # 2
Major split quantity 900

Minor split quantity 100

Prime shift factor (.XXX)
Minimum: 1.00

Most likely: 1.00

Maximum: 1.00

Second source shift factor (.XXX)
Minimum: 1.00

Most likely: 1.00

```
Maximum:  1.00

Prime rotation factor (.XXX)
Minimum:  0

Most likely:  0

Maximum:  0

Second source rotation factor (.XXX)
Minimum:  0

Most likely:  0

Maximum:  0

Another file (Y,N)?
N

Would you like to enter another mode (Y,N)
Y
```

FILE MODIFY MODE EXAMPLE SESSION

```
The following program modes are available:

    1.  Create a new data file (C)

    2.  Modify an existing data file (M)

    3.  Run using an existing data file (R)
Enter the letter shown in (  ) that corresponds to the desired mode
M

What is the name of the file you wish to modify
Testfile


(1) NUMBER OF LOTS :  2
(2) PRIME FIRST UNIT COST-MIN) 100000   MOST LIKELY) 120000   MAX) 170000
(3) SECOND SOURCE---------MIN)  90000   MOST LIKELY) 115000   MAX) 170000
(4) PRIME PCURVE SLOPE----MIN)  880     MOST LIKELY)  950     MAX)  950
(5) SECOND SOURCE---------MIN)  860     MOST LIKELY)  890     MAX)  950
(6)
LOT  LOT QUAN  SHIFT FACTOR   SHIFT FACTOR   ROTATION FACT  ROTATION FACT
#                PRIME        SECOND SOURCE     PRIME        SECOND SOURCE
   MAX  MIN  MIN  M L  MAX  MIN  M L  MAX  MIN  M L  MAX  MIN  M L  MAX
1  600  300   90   95   99   88   93   98   01   02   03   01   02   03
2  900  100  1.00 1.00 1.00 1.00 1.00 1.00  00   00   00   00   00   00


Enter the number in the (  ) that corresponds to the line you want to
modify
4

Prime performance curve slope (.XXX)
Minimum:  .88
```

```
Most likely:  .90

Maximum:  .95

Any more changes (Y,N) ? Y

Enter the number in the (  ) that corresponds to the line you want to
modify
6

What lot number to you want to modify
2

Data for lot # 2
Major split quantity 950

Minor split quantity 400

Prime shift factor (.XXX)
Minimum:  1.00

Most likely:  1.00

Maximum:  1.00

Second source shift factor (.XXX)
Minimum:  1.00

Most Likely:  1.00

Maximum:  1.00

Prime rotation factor (.XXX)
Minimum:  0

Most likely:  0

Maximum:  0

Second source rotation factor (.XXX)
Minimum:  0

Most likely:  0

Maximum:  0

Any more changes (Y,N) ? N

Would you like to enter another mode (Y,N)
Y
```

SIMULATION MODE EXAMPLE SESSION

```
The following program modes are available:

    1.  Create a new data file (C)

    2.  Modify an existing data file (M)

    3.  Run using an existing data file (R)
Enter the letter shown in (  ) that corresponds to the desired mode
R

What is the data file name?
STRATEGY3

Input random number seed (1-999999)?
123

Do you want a cumulative probability display (Y,N) ? Y

Do you want a probability density display (Y,N) ? Y

How many simulation cycles would you like (5000 is max) ? 1001

Do you want the results in discounted dollars (Y,N) N

The following output modes are available

    (1)  Output to the CRT

    (2)  Output to the line printer
Select desired output mode (1, 2)?
2

Computing results now.

Another run (Y,N) ? N

Would you like to enter another mode (Y,N) N
```

F. EXAMPLE PROGRAM OUTPUT

```
THE FOLLOWING PROGRAM MODES ARE AVAILABLE

    1. CREATE A NEW DATA FILE (C)

    2. MODIFY AN EXISTING DATA FILE (M)

    3. RUN USING AN EXISTING DATA FILE (R)

ENTER THE LETTER SHOWN IN ( ) FOR DESIRED MODE?
R

WHAT IS THE DATA FILE NAME ?
RATT

INPUT RANDOM NUMBER SEED (1 - 999999)?
123

DO YOU WANT A CUMULATIVE PROBABILITY DISPLAY (Y,N)?
Y

DO YOU WANT A PROBABILITY DENSITY DISPLAY (Y,N)?
Y

HOW MANY SIMULATION CYCLES WOULD YOU LIKE  (5000 IS MAX) ?
1001

DO YOU WANT THE RESULTS IN DISCOUNTED DOLLARS (Y,N)?
Y

WHAT LOT WILL DISCOUNTING BEGIN ?
1

THE FOLLOWING OUTPUT MODES ARE AVAILABLE
    (1) OUTPUT TO THE CRT
    (2) OUTPUT TO THE LINE PRINTER
SELECT DESIRED OUTPUT MODE (1,2)?
1

COMPUTING RESULTS NOW!
```

RUN DATE (MO/DY/YR) ---> 11/22/1985 PAGE 1

ARMY PROCUREMENT RESEARCH OFFICE (APRO)

MICROCOMPUTER VERSION OF COMPETITION DECISION ASSIST PACKAGE

--- RESULTS ARE IN DISCOUNTED DOLLARS ---
(10%) , BEGINNING WITH LOT NUMBER 1

***** AVERAGE COST = 261220 *****

***** MEDIAN COST = 260746 *****

***** MAXIMUM COST = 401861 *****

***** MINIMUM COST = 141896 *****

***** RANGE = 259965 *****

***** FOURTH-SPREAD 230975 *****
***** 290609 *****

Pause
Press (enter) to continue.

--- RESULTS ARE IN DISCOUNTED DOLLARS ---
(10%) , BEGINNING WITH LOT NUMBER 1

PRIME SPLIT WIN PERCENTAGE			AVERAGE LOT	AVERAGE UNIT COSTS		
LOT #	%	LOT QUANTITY	COST	PRIME	SECOND SOURCE	COMPOSITE
1	100.00	600	74537 *	128 *	117 *	124 *
2	36.36	800	64931 *	97 *	81 *	81 *
3	36.36	1200	79923 *	83 *	65 *	67 *
4	34.87	900	41829 *	50 *	45 *	46 *

TOTAL NUMBER OF UNITS = 3500

Pause
Press (enter) to continue.

PRIME FIRST UNIT COST--MIN>	100	MOST LIKELY>	200	MAX>	300
SECOND SOURCE----------MIN>	100	MOST LIKELY>	220	MAX>	250
PRIME PCURVE SLOPE-----MIN>	900	MOST LIKELY>	950	MAX>	980
SECOND SOURCE----------MIN>	900	MOST LIKELY>	930	MAX>	960

NUMBER OF CYCLES---> 1001

LOT #	LOT QUAN MAX	LOT QUAN MIN	SHIFT FACTOR PRIME MIN	SHIFT FACTOR PRIME M.L.	SHIFT FACTOR PRIME MAX	SHIFT FACTOR SECOND SOURCE MIN	SHIFT FACTOR SECOND SOURCE M.L.	SHIFT FACTOR SECOND SOURCE MAX	ROTATION FACT PRIME MIN	ROTATION FACT PRIME M.L.	ROTATION FACT PRIME MAX	ROTATION FACT SECOND SOURCE MIN	ROTATION FACT SECOND SOURCE M.L.	ROTATION FACT SECOND SOURCE MAX
1	400.	200.	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00
2	600.	200.	.90	.94	.98	.90	.92	.95	.01	.02	.03	.01	.02	.03
3	900.	300.	1.00	1.00	1.00	1.00	1.00	1.00	.01	.01	.01	.01	.01	.01
4	900.	0.	.95	.96	.98	.90	.92	.95	.00	.00	.00	.00	.00	.00

Pause.
Press (enter) to continue.

RUN DATE (MO/DY/YR) ---> 11/22/1985 PAGE 2

STRATEGY COST CUMULATIVE PROBABILITY

```
              0.00  .10  .20  .30  .40  .50  .60  .70  .80  .90 1.00
               +----+----+----+----+----+----+----+----+----+----+
      141896.  |                                                    .0000
      144496.  |                                                    .0030
      149695.  |                                                    .0040
      154894.  |                                                    .0060
      160093.  |                                                    .0100
      165293.  |*                                                   .0140
      170492.  |*                                                   .0230
      175691.  |*                                                   .0300
      180891.  |**                                                  .0430
      186090.  |**                                                  .0500
      191289.  |***                                                 .0589
      196489.  |****                                                .0809
      201688.  |*****                                               .1059
      206887.  |******                                              .1289
      212086.  |********                                            .1548
      217286.  |*********                                           .1768
      222485.  |**********                                          .2098
      227684.  |************                                        .2448
      232884   |**************                                      .2857
      238083.  |****************                                    .3267
      243282.  |********************                                .3766
      248481.  |**********************                              .4166
      253681.  |************************                            .4605
      258880.  |****************************                        .5065
      264079   |********************************                    .5554
      269279.  |**********************************                  .5964
      274478   |************************************                .6414
      279677.  |**************************************              .6893
      284876   |****************************************            .7213
```

```
        290076  |****************************************                  .7632
        295275  |*****************************************                 .8012
        300474  |******************************************                .8292
        305674  |*******************************************               .8521
        310873  |********************************************              .8761
        316072  |*********************************************             .9061
        321271  |**********************************************            .9201
        326471  |***********************************************           .9321
        331670  |***********************************************           .9421
        336869  |************************************************          .9560
        342069  |************************************************          .9620
        347268  |************************************************          .9660
        352467  |*************************************************         .9750
        357666  |*************************************************         .9810
        362866  |*************************************************         .9840
        368065  |*************************************************         .9880
        373264  |**************************************************        .9920
        378464  |**************************************************        .9940
        383663  |**************************************************        .9970
        388862  |**************************************************        .9980
        394061  |**************************************************        .9990
        399261  |**************************************************  1.0000
                +----+----+----+----+----+----+----+----+----+----+
              0.00  .10  .20  .30  .40  .50  .60  .70  .80  .90 1.00
STRATEGY COST                    CUMULATIVE PROBABILITY
Pause.
Press <enter> to continue.
```

```
RUN DATE (MO/DY/YR) --->   11/22/1985          PAGE  3
STRATEGY COST                          PROBABILITY
              0.00  .01  .02  .03  .04  .05  .06  .07  .08  .09  .10
                +----+----+----+----+----+----+----+----+----+----+
        141896  |                                                    .0000
        144496  |*                                                   .0030
        149695  |                                                    .0010
        154894  |*                                                   .0020
        160093  |**                                                  .0040
        165293  |**                                                  .0040
        170492  |****                                                .0090
        175691  |***                                                 .0070
        180891  |******                                              .0130
        186090  |***                                                 .0070
        191289  |****                                                .0090
        196489  |**********                                          .0220
        201688  |***********                                         .0250
        206887  |**********                                          .0230
        212086  |***********                                         .0260
```

```
217286.  |**********                                                0220
222485.  |****************                                          0330
227684.  |****************                                          0350
232884.  |********************                                      0410
238083.  |********************                                      0410
243282.  |**************************                                0500
248481.  |********************                                      0400
253681.  |**********************                                    0440
258880.  |************************                                  0460
264079.  |**************************                                0490
269279.  |********************                                      0410
274478.  |************************                                  0450
279677.  |**************************                                0480
284876.  |****************                                          0320
290076.  |**********************                                    0420
295275.  |********************                                      0380
300474.  |**************                                            0280
305674.  |**********                                                0230
310873.  |***********                                               0240
316072.  |****************                                          0300
321271.  |*******                                                   0140
326471.  |******                                                    0120
331670.  |*****                                                     0100
336869.  |*******                                                   0140
342069.  |***                                                       0060
347268.  |**                                                        0040
352467.  |****                                                      0090
357666.  |***                                                       0060
362866.  |*                                                         0030
368065.  |**                                                        0040
373264.  |**                                                        0040
378464.  |*                                                         0020
383663.  |*                                                         0030
388862.  |                                                          0010
394061.  |                                                          0010
399261.  |                                                          0010
         +----+----+----+----+----+----+----+----+----+----+
       0 00   01   02   03   04   05   06   07   08   09   10
STRATEGY COST                      PROBABILITY
```

Pause
Press (enter) to continue

ANOTHER RUN (Y,N) ?
N

```
WOULD YOU LIKE TO ENTER ANOTHER MODE (Y,N)?
N

CDAP FINISHED  --  GOOD DAY!
Stop - Program terminated.
```

APPENDIX B

CDAPM

SYSTEM FLOWCHART

The CDAPM computer program consists of a main routine containing all the simulation logic and 12 subroutines which are called from the main program. The subroutines are used for housekeeping and formatting chores, are straightforward, do not affect the program logic and are therefore not flowcharted. They are listed alphabetically for reference in Figure B-1.

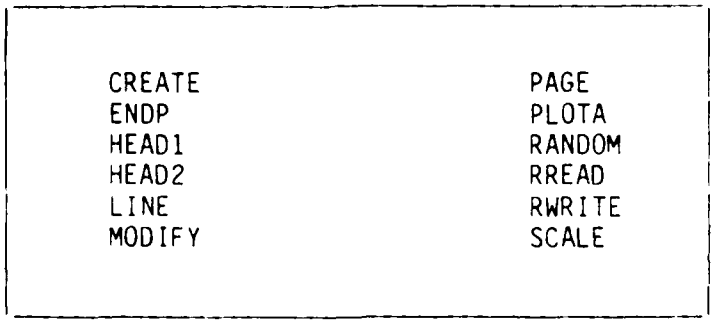
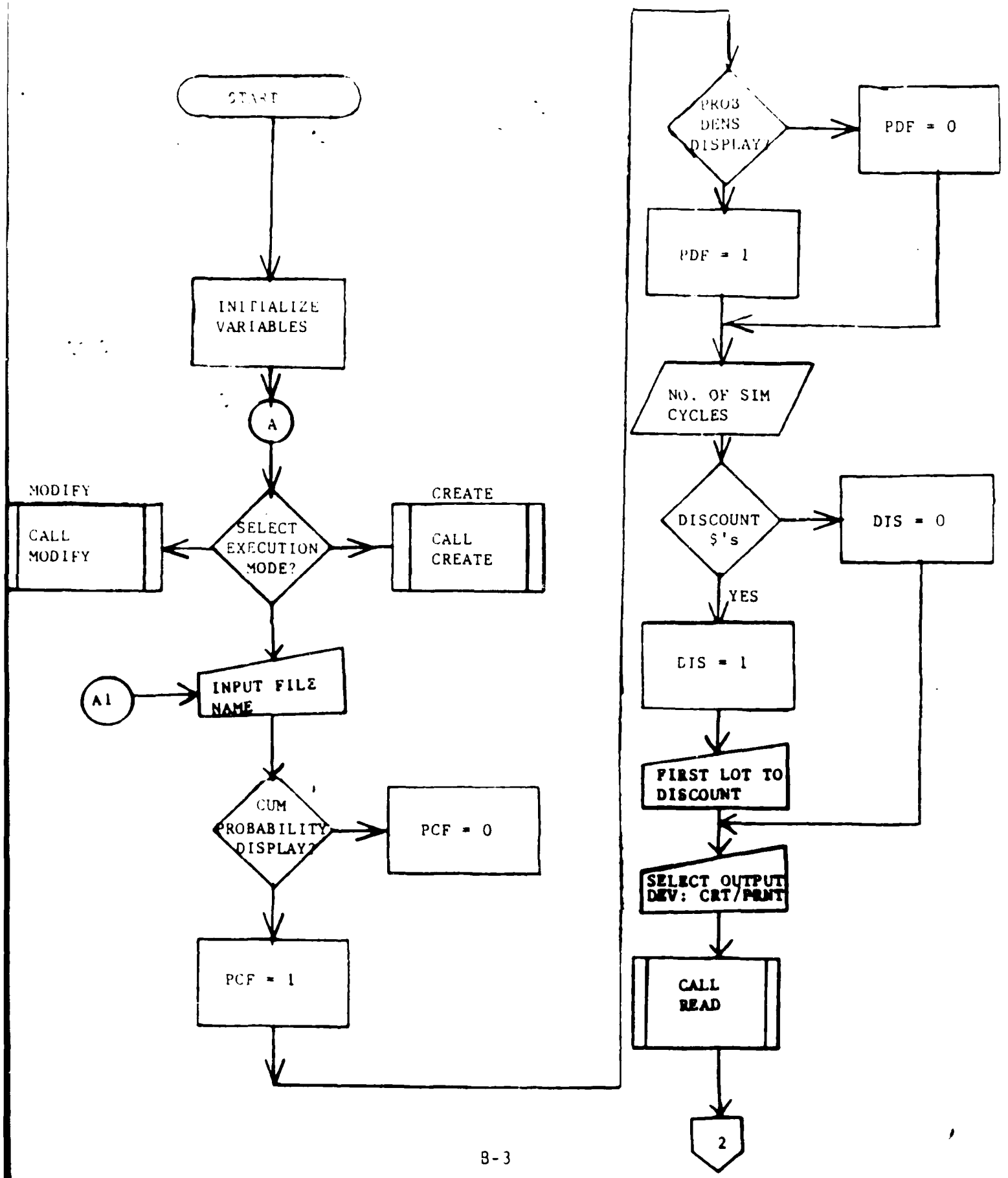
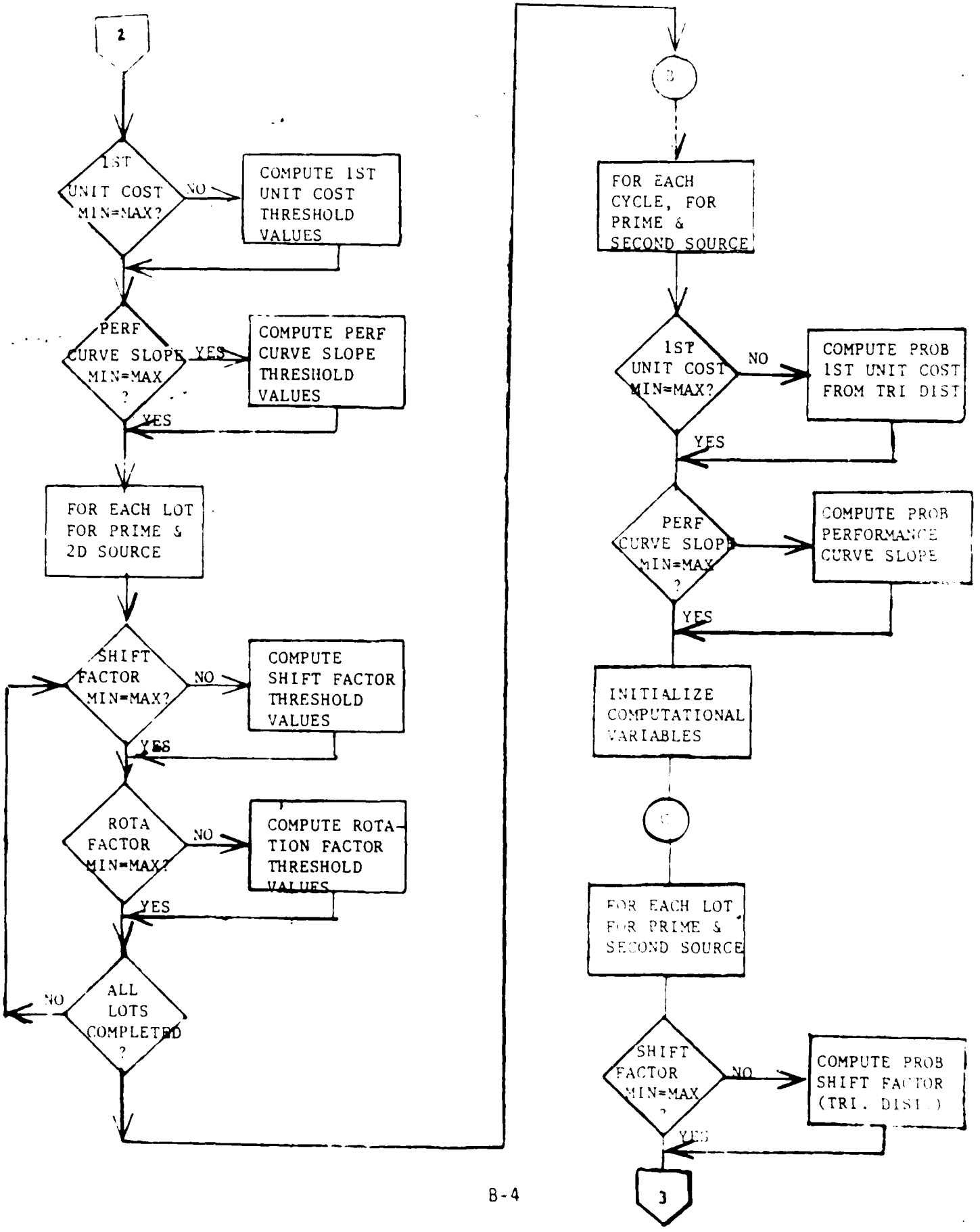
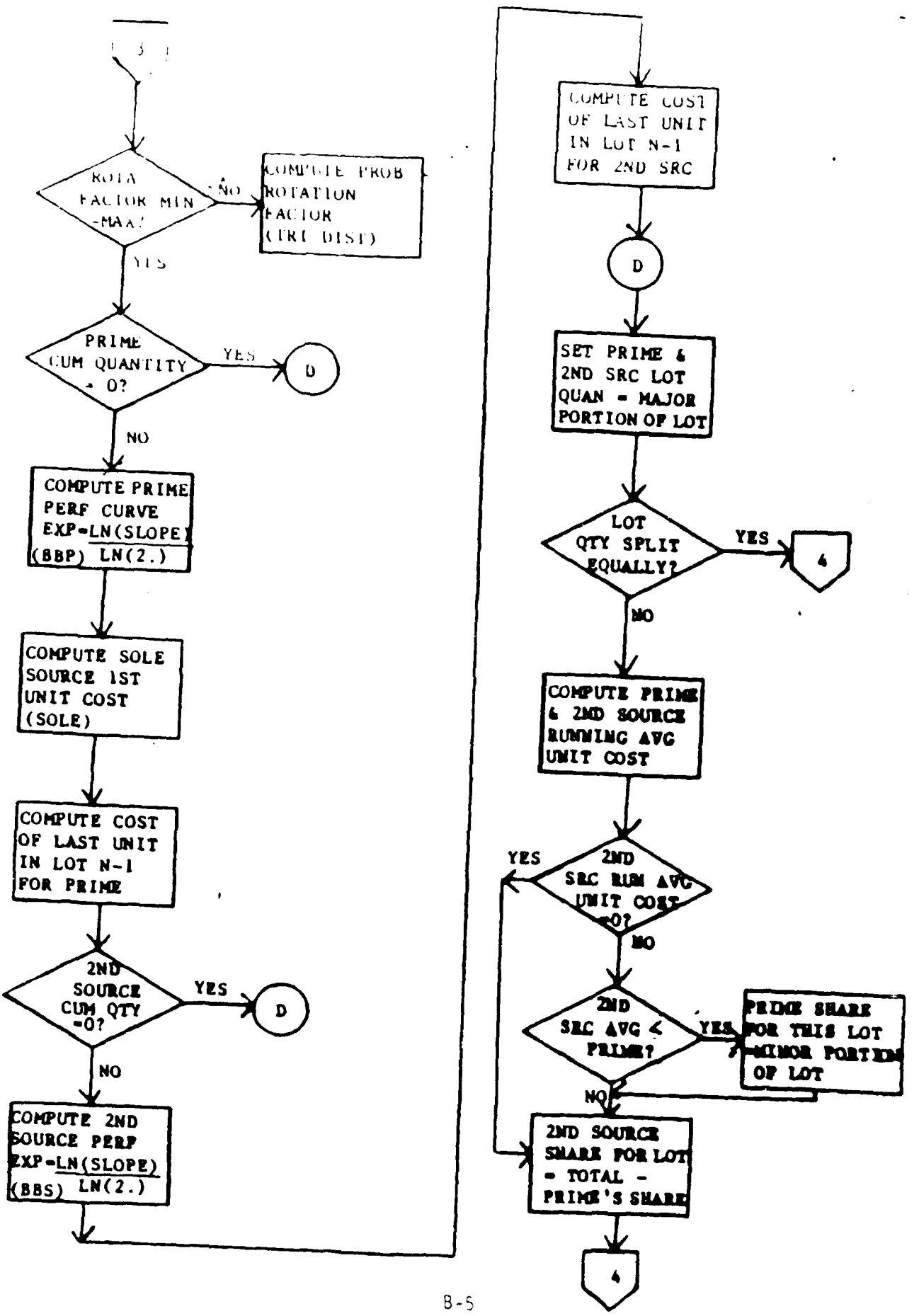
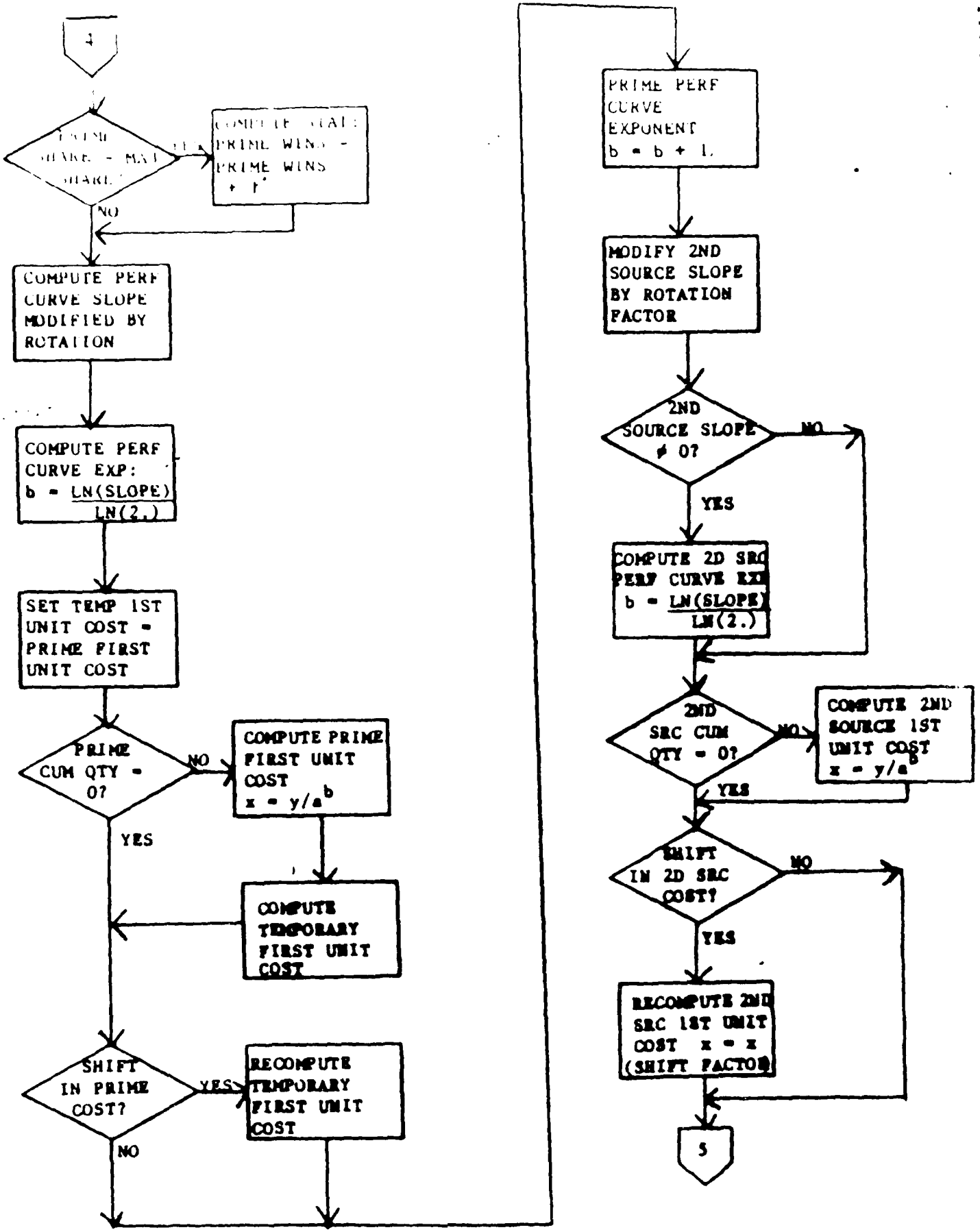


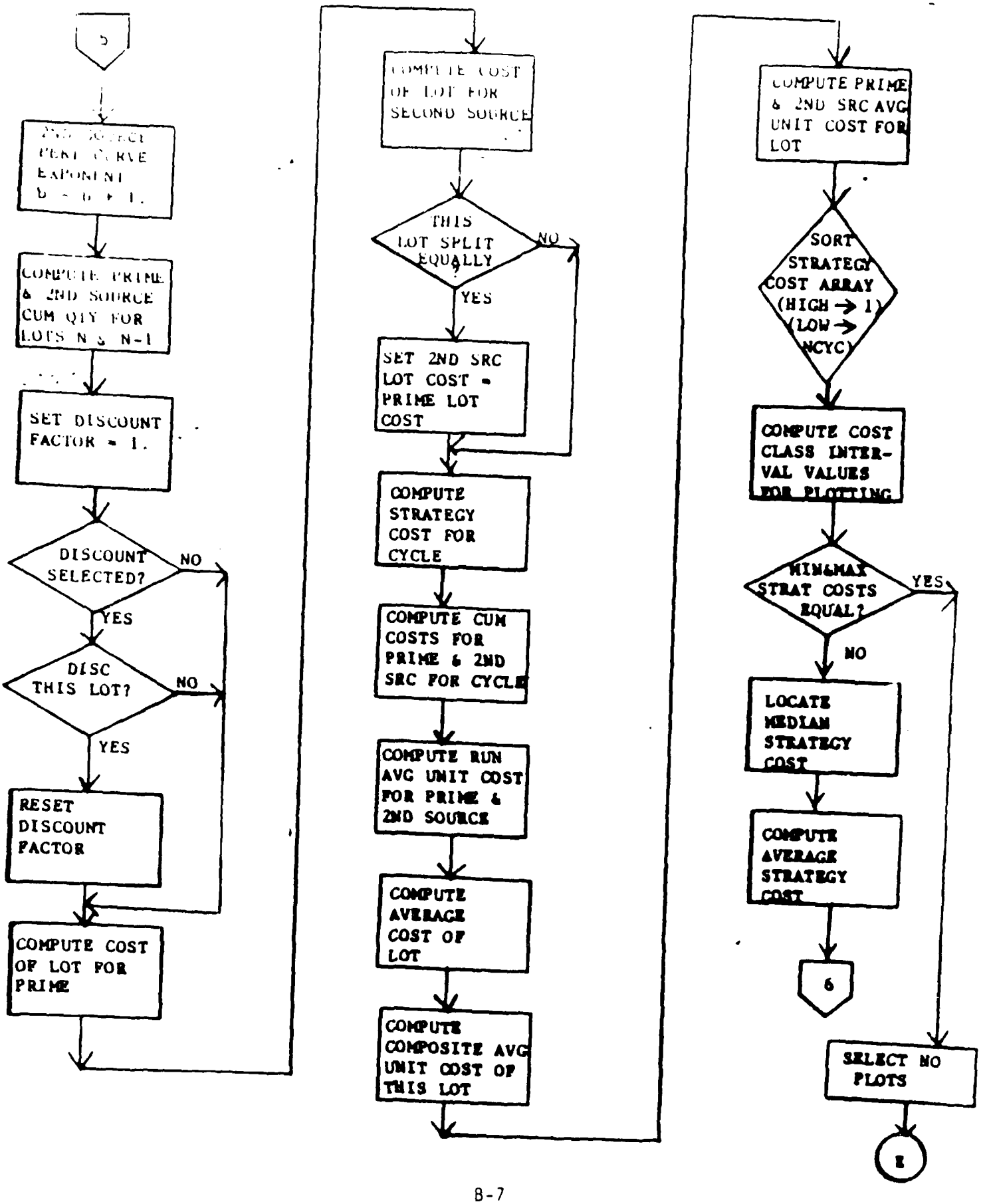
FIGURE B-1. CDAPM Subroutines

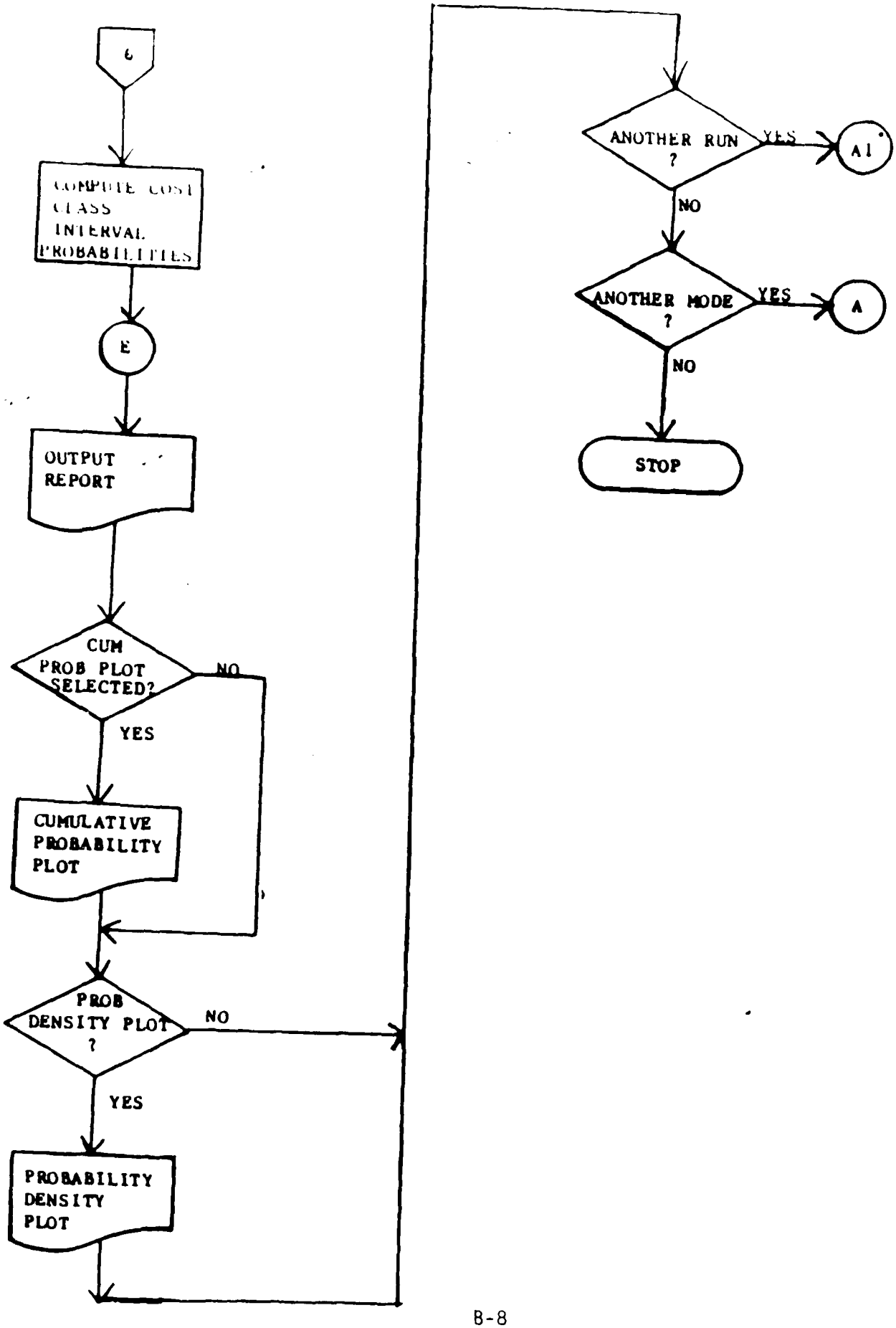

START
INITIALIZE VARIABLES
A
MODIFY
CALL MODIFY
SELECT EXECUTION MODE?
CREATE
CALL CREATE
A1
INPUT FILE NAME
CUM PROBABILITY DISPLAY?
PCF = 0
PCF = 1
PROB DENS DISPLAY?
PDF = 0
PDF = 1
NO. OF SIM CYCLES
DISCOUNT $'s
DIS = 0
YES
DIS = 1
FIRST LOT TO DISCOUNT
SELECT OUTPUT DEV: CRT/PRNT
CALL READ
2


2
1ST UNIT COST MIN=MAX?
NO
COMPUTE 1ST UNIT COST THRESHOLD VALUES
PERF CURVE SLOPE MIN=MAX ?
YES
COMPUTE PERF CURVE SLOPE THRESHOLD VALUES
YES
FOR EACH LOT FOR PRIME & 2D SOURCE
SHIFT FACTOR MIN=MAX?
NO
COMPUTE SHIFT FACTOR THRESHOLD VALUES
YES
ROTA FACTOR MIN=MAX?
NO
COMPUTE ROTATION FACTOR THRESHOLD VALUES
YES
ALL LOTS COMPLETED ?
NO
3
FOR EACH CYCLE, FOR PRIME & SECOND SOURCE
1ST UNIT COST MIN=MAX?
NO
COMPUTE PROB 1ST UNIT COST FROM TRI DIST
YES
PERF CURVE SLOPE MIN=MAX ?
COMPUTE PROB PERFORMANCE CURVE SLOPE
YES
INITIALIZE COMPUTATIONAL VARIABLES
FOR EACH LOT FOR PRIME & SECOND SOURCE
SHIFT FACTOR MIN=MAX ?
NO
COMPUTE PROB SHIFT FACTOR (TRI. DIST.)
YES
3


ROTA FACTOR MIN -MAX?
NO
COMPUTE PROB ROTATION FACTOR (TRI DIST)
YES
PRIME CUM QUANTITY = 0?
YES
D
NO
COMPUTE PRIME PERF CURVE EXP=LN(SLOPE) / LN(2.) (BBP)
COMPUTE SOLE SOURCE 1ST UNIT COST (SOLE)
COMPUTE COST OF LAST UNIT IN LOT N-1 FOR PRIME
2ND SOURCE CUM QTY =0?
YES
D
NO
COMPUTE 2ND SOURCE PERF EXP=LN(SLOPE) / LN(2.) (BBS)
COMPUTE COST OF LAST UNIT IN LOT N-1 FOR 2ND SRC
D
SET PRIME & 2ND SRC LOT QUAN = MAJOR PORTION OF LOT
LOT QTY SPLIT EQUALLY?
YES
4
NO
COMPUTE PRIME & 2ND SOURCE RUNNING AVG UNIT COST
YES
2ND SRC RUN AVG UNIT COST =0?
NO
2ND SRC AVG < PRIME?
YES
PRIME SHARE FOR THIS LOT = MINOR PORTION OF LOT
NO
2ND SOURCE SHARE FOR LOT = TOTAL - PRIME'S SHARE
4


4
[illegible] SHARE = MAX SHARE?
YES
[illegible] PRIME WINS = PRIME WINS + 1
NO
COMPUTE PERF CURVE SLOPE MODIFIED BY ROTATION
COMPUTE PERF CURVE EXP: b = LN(SLOPE) / LN(2.)
SET TEMP 1ST UNIT COST = PRIME FIRST UNIT COST
PRIME CUM QTY = 0?
NO
COMPUTE PRIME FIRST UNIT COST x = y/a^b
YES
COMPUTE TEMPORARY FIRST UNIT COST
SHIFT IN PRIME COST?
YES
RECOMPUTE TEMPORARY FIRST UNIT COST
NO
PRIME PERF CURVE EXPONENT b = b + 1.
MODIFY 2ND SOURCE SLOPE BY ROTATION FACTOR
2ND SOURCE SLOPE ≠ 0?
NO
YES
COMPUTE 2D SRC PERF CURVE EXP b = LN(SLOPE) / LN(2.)
2ND SRC CUM QTY = 0?
NO
COMPUTE 2ND SOURCE 1ST UNIT COST x = y/a^b
YES
SHIFT IN 2D SRC COST?
NO
YES
RECOMPUTE 2ND SRC 1ST UNIT COST x = x (SHIFT FACTOR)
5


5
2ND SOURCE CURVE EXPONENT B = B + 1.
COMPUTE PRIME & 2ND SOURCE CUM QTY FOR LOTS N & N-1
SET DISCOUNT FACTOR = 1.
DISCOUNT SELECTED?
NO
YES
DISC THIS LOT?
NO
YES
RESET DISCOUNT FACTOR
COMPUTE COST OF LOT FOR PRIME
COMPUTE COST OF LOT FOR SECOND SOURCE
THIS LOT SPLIT EQUALLY?
NO
YES
SET 2ND SRC LOT COST = PRIME LOT COST
COMPUTE STRATEGY COST FOR CYCLE
COMPUTE CUM COSTS FOR PRIME & 2ND SRC FOR CYCLE
COMPUTE RUN AVG UNIT COST FOR PRIME & 2ND SOURCE
COMPUTE AVERAGE COST OF LOT
COMPUTE COMPOSITE AVG UNIT COST OF THIS LOT
COMPUTE PRIME & 2ND SRC AVG UNIT COST FOR LOT
SORT STRATEGY COST ARRAY (HIGH → 1) (LOW → NCYC)
COMPUTE COST CLASS INTERVAL VALUES FOR PLOTTING
MIN&MAX STRAT COSTS EQUAL?
YES
NO
LOCATE MEDIAN STRATEGY COST
COMPUTE AVERAGE STRATEGY COST
6
SELECT NO PLOTS
E


6
COMPUTE COST
CLASS
INTERVAL
PROBABILITIES
E
OUTPUT
REPORT
CUM
PROB PLOT
SELECTED?
NO
YES
CUMULATIVE
PROBABILITY
PLOT
PROB
DENSITY PLOT
?
NO
YES
PROBABILITY
DENSITY
PLOT
ANOTHER RUN
?
YES
A1
NO
ANOTHER MODE
?
YES
A
NO
STOP

APPENDIX C

CDAPM

SOURCE CODE LISTING

```
D Line# 1     7                    IBM Personal Computer FORTRAN Compiler V2 00
      1 ********************************
      2 C*
      3 C* VARIABLES DEFINITION
      4 C*
      5 C********************************
      6 C ACLOT(25)    AVERAGE COST OF LOT N
      7 C ALUC(25)     AVERAGE UNIT COST FOR LOT N (COMPOSITE)
      8 C AMID         MEDIAN STRATEGY COST FROM SIMULATION RESULTS
      9 C AP           PRIME SHIFTED FIRST UNIT COST AT LOT N AND A GIVEN SIM CYC
     10 C APUCL(25)    AVERAGE UNIT COST FOR THE PRIME IN LOT N
     11 C ASUCL(25)    AVERAGE UNIT COST FOR THE SECOND SOURCE IN LOT  N
     12 C AS           SS SHIFTED FIRST UNIT COST FOR LOT N AND A GIVEN  SIM CYC
     13 C AVG          AVERAGE STRATEGY COST
     14 C BBP          ROTATED PRIME SLOPE AT LOT N AND A GIVEN SIM CYCLE
     15 C BBS          ROTATED SECOND SOURCE SLOPE AT LOT N AND A GIVEN  SIM CYC
     16 C BP(3)        PRIME PERFORMANCE CURVE SLOPE VALUES--MIN, ML.  MAX
     17 C BPT          PRIME SLOPE TRIANGULAR DISTRIBUTION THRESHOLD  VALUE
     18 C BSS(3)       SECOND SOURCE PERFORMANCE CURVE SLOPE VALUES(MIN,ML,MAX)
     19 C BSST         SECOND SOURCE SLOPE TRIANGULAR DIST THRESHOLD  VALUE
     20 C CIP(3)       FIRST UNIT COST FOR THE PRIME--MIN, ML, MAX
     21 C CIPT         PRIME FIRST UNIT COST TRIANGULAR DIST THRESHOLD  VALUE
     22 C CISS(3)      FIRST UNIT COST FOR THE SECOND SOURCE--MIN,  ML, MAX
     23 C CISST        SECOND SOURCE FIRST UNIT COST TRIANG DIST THRESHOLD  VALUE
     24 C COST         VARIABLE USED TO PRINT THE COST VALUES USED IN OUTPUT PLOT
     25 C CUM          SELECTS PROPER MODE FOR CUM PROB DISPLAY(1=CUM.  0=PDF)
     26 C CWP(25)      PRIME WIN PERCENTAGE FOR LOT N
     27 C CYCLES       FLOATING POINT VERSION OF NCYC (SIMULATION CYCLES)
     28 C DEV          OUTPUT DEVICE ID (0 = CONSOLE, 1 = LPT1)
     29 C DF           DISCOUNT FACTOR USED IN CALCULATING LOT COSTS
     30 C DIS          SELECTION PARAMETER FOR IMPLEMENTING DISCOUNTING
     31 C DISC(25)     INDIVIDUAL DISCOUNT FACTORS USING A 10% RATE
     32 C DP           VALUE USED IN CALCULATING AVG UNIT COST OF PRIME  AT LOT
     33 C DS           VALUE USED IN CALCULATING AVG UNIT COST OF SS  AT LOT N
     34 C FINC         CLASS INTERVAL VALUE FOR SETTING UP THE OUTPUT  PLOTS
     35 C FNAME        VARIABLE USED TO READ THE DATA FILE NAME
     36 C HOLD         TEMPORARY VARIABLE USED IN SORTING THE SIMULATION  VALUES
     37 C ICK          TEMPORARY VARIABLE USED DURING VALUE SORTING  AND TESTS
     38 C IDF          LOT NUMBER THAT DISCOUNTING WILL BEGIN
     39 C ITT          TOP OF FORM PRINT VARIABLE FOR IMPACT TERMINALS
     40 C IVAL         INTERGER VARIABLE USED TO SCALE THE OUTPUT PLOT LINES
     41 C LINE         DATA FILE MODIFICATION ENTRY POINT (*MODIFY)
     42 C LOTN         DATA FILE MODIFICATION LOT ENTRY POINT (*MODIFY)
     43 C M1           ARGUMENT OG SUBROUTINE *CREATE -- ENTRY POINT FROM MODIFY
     44 C M2           ARGUMENT OF SUBROUTINE *CREATE -- BEGINNING LOT NUMBER
     45 C M3           ARGUMENT OF SUBROUTINE *CREATE -- ENDING LOT NUMBER
     46 C NCYC         NUMBER OF SIMULATION CYCLES ---- INPUT PRIOR  TO RUN
     47 C NLN          LENGTH OF DATA FILE NAME
     48 C NLOT         NUMBER OF LOTS READ FROM THE DATA FILE
     49 C NLOTM        MODIFIED NUMBER OF LOTS FROM *MODIFY
     50 C NLOTP        CURRENT NUMBER OF LOTS+1 -- USED IN *MODIFY
     51 C PAVG         PRIME RUNNING AVERAGE UNIT COST AT LOT N AND  A GIVEN SIM
     52 C PB           PRIME PERFORMANCE CURVE SLOPE FOR CYCLE N OF THE SIM
     53 C PC(50)       CALCULATED CLASS INTERVAL PROBABILITY
     54 C PCOST(50)    CALCULATED COST CLASS INTERVAL PROBABILITY
     55 C PCF          CUMULATIVE PROBABILITY DENSITY DISPLAY OPTION(1=YES,0=NO)
     56 C PDF          PROBABILITY DENSITY DISPLAY OPTION (0=NO.  1=YES)
     57 C PFUC         PRIME FIRST UNIT COST FOR CYCLE N OF THE SIMULATION
     58 C PPCOST       PRIME RUNNING CUMULATIVE COST FOR A GIVEN SIMULATION  CYC
     59 C PROT         PRIME ROTATION FACTOR FOR LOT N AND A GIVEN SIM CYC
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2.00
     60 C  PSF          PRIME SHIFT FACTOR FOR LOT N AND A GIVEN SIM CYCLE
     61 C  PUCOST       PRIME UNIT COST FOR LAST ITEM IN LOT N-1 FOR  A SIM CYCLE
     62 C  PV(50)       HISTOGRAM PLOT VAR (DEFINES PHYSICAL NUM OF  PLOT POINTS)
     63 C  Q1P          LAST UNIT NUMBER FOR PRIME AT LOT N-1 AND A GIVEN SIM CYC
     64 C  Q1S          LAST UNIT NUMBER FOR THE S S AT LOT N-1 AND SIM CYCLE
     65 C  Q2P          LAST UNIT NUMBER FOR PRIME A LOT N AND A GIVEN  SIM CYCLE
     66 C  Q2S          LAST UNIT NUM FOR SECOND SOURCE FOR LOT N AND GIVEN SIM CY
     67 C  QM(25)       MAJOR SPLIT QUANTITY FOR LOT N
     68 C  QP           PRIME LOT QUANTITY FOR LOT N FOR A GIVEN SIMULATION  CYCLE
     69 C  QPC          PRIME CUMULATIVE QUANTITY FOR CYCLE N  OF THE  SIMULATION
     70 C  QS(25)       MINOR SPLIT QUANTITY FOR LOT N
     71 C  QSS          SECOND SOURCE QUANTITY FOR LOT N FOR A GIVEN SIM CYCLE
     72 C  QSSC         SECOND SOURCE CUM QUANTITY FOR CYCLE N OF THE  SIMULATION
     73 C  RN           RANDOM NUMBER USED IN THE SIMULATION
     74 C  ROTP(25,3)   PRIME SLOPE ROTATION FACTOR FOR LOT N --- MIN,  ML, MAX
     75 C  ROTPT        PRIME SLOPE RGTATION TRIANGULAR DIST THRESHOLD  VALUE
     76 C  ROTSS(25,3)  SECOND SOURCE SLOPE ROTATION FACTOR FOR LOT N(MIN,ML,MAX)
     77 C  ROTSST       SECOND SOURCE ROTATION TRIANGULAR DIST THRESHOLD  VALUE
     78 C  SAVG         SECOND SOURCE RUNNING AVERAGE UNIT COST AT LOT  N AND CYC
     79 C  SCOST(5000)  STRATEGY COST FOR THE NTH SIMULATION CYCLE
     80 C  SF           SCALE FACTOR USED IN SCALE SUBROUTINE
     81 C  SFP(25,3)    PRIME FIRST UNIT COST SHIFT FACTOR FOR LOT N(MIN,ML,MAX)
     82 C  SFPT         PRIME SHIFT FACTOR TRIANGULAR DISTRIBUTION THRES  VALUE
     83 C  SFSS(25,3)   SECOND SOURCE FIRST UNIT COST SHIFT FOR LOT N(MIN,ML,MAX)
     84 C  SFSST        SECOND SOURCE SHIFT FACTOR TRIANGULAR DIST THRES  VALUE
     85 C  SOLE         SOLE SOURCE FIRST UNIT COST-- USED FOR REFERENCING  SHIFT
     86 C  SSB          SECOND SOURCE PERFORMANCE CURVE SLOPE FOR CYCLE  N OF THE
     87 C  SSCOST       SECOND SOURCE RUNNING CUMULATIVE COST FOR A  GIVEN SIM CY
     88 C  SSFUC        SECOND SOURCE FIRST UNIT COST FOR CYCLE N OF THE SIM
     89 C  SSROT        SECOND SOURCE ROTATION FACT FOR LOT N AND A  GIVEN SIM CY
     90 C  SSSF         SECOND SOURCE SHIFT FACTOR FOR LOT N AND A GIVEN  SIM CYC
     91 C  SUCOST       SECOND SOURCE UNIT COST FOR LAST UNIT OF LOT  N-1 AND CYC
     92 C  TCK          VARIABLE USED TO INDICATE TYPE OF TERMINAL BEING USED
     93 C  TFUC         TEMP FIRST UNIT COST USED BETWEEN LOTS SPECIFYING  SHIFTS
     94 C  TOTAL        VALUE USED TO PRINT TOTAL LOT QUANITIES
     95 C  TTYP         VARIABLE USED TO INPUT TERMINAL TYPE (IMPACT OR THERMAL)
     96 C  VAL          VARIABLE USED TO PRINT PROBABILITY VALUES IN OUTPUT PLOTS
     97 C  YP           COST OF LOT N FOR THE PRIME FOR A GIVEN SIMULATION  CYCLE
     98 C  YS           COST OF LOT N FOR THE SS FOR A GIVEN SIMULATION  CYCLE
     99 C
    100 C*****************************************************************************
    101 C
    102 C*****************************************************************************
    103 C* THIS PROGRAM SETS UP A SIMULATION OF TWO PRODUCERS OPERATING IN A
    104 C* COMPETITIVE ENVIRONMENT   THE PURPOSE OF THE SIMULATION IS TO
    105 C* CALCULATE THE COST OF ACQUIRING THE TOTAL QUANTITY OF ITEMS MADE BY
    106 C* BOTH SOURCES   CONSIDERED IN THIS SIMULATION PROGRAM ARE THE EFFECTS
    107 C* OF QUANTITY PRODUCED ON UNIT PRICE (PRICE PERF  CURVES, OR LEARNING
    108 C* CURVES).  INFLUENCE OF COMPETITION ON UNIT PRICE UNDER CONDITIONS OF
    109 C* MULTIPLE CONTRACT AWARDS  AND THE EFFECT OF COMPETITION ON RELATIVE
    110 C* PRODUCTION EFFICIENCY   DATA FOR THIS PROGRAM IS READ FROM A FILE
    111 C* THAT IS PREPARED AND MAINTAINED BY A UTILITY WITHIN THIS  PROGRAM
    112 C* THIS PROGRAM WAS ORIGINALLY CODED FOR USE ON A PRIME COMPUTER BY
    113 C*
    114 C*                    US ARMY TANK AUTOMOTIVE COMMAND
    115 C*                    SYSTEMS AND COST ANALYSIS DIRECTORATE
    116 C*                    DRSTA-VS (MR  PAUL BRADLEY)
    117 C*                    WARREN  MICHIGAN  48090
    118 C*
```

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     C*************************************************************************
     C*
     C* THIS VERSION OF THE PROGRAM HAS BEEN CODED SPECIFICALLY FOR THE
     C* COMPAQ PLUS MICROCOMPUTER AND OTHER IBM COMPATIABLE MICROCOMPUTER SYS
     C* USING IBM FORTRAN COMPILER VERSION 2 00 (MICROSOFT FORTRAN)
     C* IMPROVEMENTS, AND CORRECTIONS TO THE PROGRAM LOGIC HAVE BEEN MADE, AS
     C* NEEDED.  A REPORT DOCUMENTING THE OPERATION AND FEATURES OF THIS
     C* MODIFIED VERSION IS APRO 85-06 AND IS AVAILABLE FROM
     C*
     C*              ARMY PROCUREMENT RESEARCH OFFICE
     C*              ATTN: DALO-PRO  (MR  ANDERSON J  LATTIMORE)
     C*              FORT LEE, VA  23801-6045
     C*
     C*************************************************************************
           COMMON/A/PV(51),PCOST(50),SCOST(5000)
           COMMON/RD/FID(12),CIP(3),CISS(3),BP(3),BSS(3),QM(25),
          +QS(25),SFP(25,3),SFSS(25,3),ROTP(25,3),ROTSS(25,3),ACLOT(25),
          +ALUC(25),APUCL(25),ASUCL(25),FNAME,NLOT,IYEAR,IMONTH,IDAY
           REAL*8 PV,PCOST,SCOST,FID,CIP,CISS,ACLOT,ALUC,BP,BSS, SFP,SFSS,
          +ROTP,ROTSS,SFPT(25),SFSST(25),ROTPT(25),ROTSST(25),QM, QS,CWP(25)
          +,AVG,COST,PPCOST,SSCOST,PAVG,SAVG,YP,YS,SSFUC,PFUC,ASUCL,APUCL
           REAL DISC(25)
           CHARACTER CH,ANS,TICK
           CHARACTER*12 FNAME
           INTEGER TCK,DEV
           INTEGER*2 IYEAR,IMONTH,IDAY
           INTEGER*4 TOTAL
           DOUBLE PRECISION IX,RANDOM
           LOGICAL OPN,SHOW
           DATA DISC/ 954, 867, 788, 717, 652, 592, 538, 489, 445,  405,
          + 368, 334, 304, 276, 251, 228, 208, 189, 172, 156, 142, 129,
          + 117, 107, 097/,M1/0/,M2/0/,M3/0/
           ITT=12
           CH=CHAR(27)
           DEV = 0
           OPEN(1,FILE='LPT1')
           CALL GETDAT(IYEAR,IMONTH,IDAY)
     C*************************
     C*
     C* DISPLAY MENU OF RUN MODES  CREATE A NEW FILE, MODIFY EXISTING FILE
     C* AND RUN THE SIMULATION FROM AN EXISTING FILE
     C*
     C*************************
      510  WRITE(*,520)
           WRITE(*,522)
           WRITE(*,524)
           WRITE(*,526)
           WRITE(*,540)
      520  FORMAT(/1X,'THE FOLLOWING PROGRAM MODES ARE AVAILABLE    ')
      522  FORMAT(/5X,'1  CREATE A NEW DATA FILE (C)')
      524  FORMAT(/5X,'2  MODIFY AN EXISTING DATA FILE (M)')
      526  FORMAT(/5X,'3  RUN USING AN EXISTING DATA FILE (R)')
      540  FORMAT(/1X,'ENTER THE LETTER SHOWN IN ( ) FOR DESIRED MODE? ')
           READ(*,1250) ANS
           IF( ( ANS  EQ  'C' )  OR  ( ANS  EQ  'c' ) ) CALL CREATE(M1,M2,M3)
           IF( ( ANS  EQ  'M' )  OR  ( ANS  EQ  'm' ) ) CALL MODIFY
           IF( ( ANS  EQ  'R' )  OR  ( ANS  EQ  'r' ) ) GOTO 570
      550  WRITE(*,560)
      560  FORMAT(/1X,'WOULD YOU LIKE TO ENTER ANOTHER MODE (Y,N)? ')
```

```
D Line# 1      7                        IBM Personal Computer FORTRAN Compiler V2 00
     178        READ(*,1250) ANS
     179        IF ( ( ANS  NE  'Y' )  AND  ( ANS  NE  'y' ) ) GOTO 1255
     180        GOTO 510
     181    570 WRITE(*,580)
     182    580 FORMAT(/1X,'WHAT IS THE DATA FILE NAME ?')
     183        READ(*,590) FNAME
     184    590 FORMAT(A12)
     185 C**************************
     186 C*
     187 C* SET UP RUN PARAMETERS
     188 C*
     189 C**************************
     190 C
     191 600    WRITE(*,610)
     192 610    FORMAT(/1X,'INPUT RANDOM NUMBER SEED (1 - 999999)? ')
     193        READ(*,625) IY
     194        if ( ( iy  LT  1 )  OR  ( iy  GT  999999 ) ) goto 600
     195 C****************** a future version of CDAPM will use date/time as seed
     196        IX=IY
     197        DO 615 I=1,100
1    198        RN=RANDOM(IX)
1    199    615 CONTINUE
     200        PDF=0
     201        PCF=0
     202        WRITE(*,620)
     203    620 FORMAT(/1X,'DO YOU WANT A CUMULATIVE PROBABILITY DISPLAY (Y N)? ')
     204        READ(*,1250) ANS
     205        IF ( ( ANS  EQ  'Y' )  OR  ( ANS  EQ  'y' ) ) PCF=1
     206        WRITE(*,630)
     207    630 FORMAT(/1X,'DO YOU WANT A PROBABILITY DENSITY DISPLAY (Y,N)?')
     208        READ(*,1250) ANS
     209        IF ( ( ANS  EQ  'Y' )  OR  ( ANS  EQ  'y' ) ) PDF=1
     210    640 WRITE(*,650)
     211    650 FORMAT(/1X,'HOW MANY SIMULATION CYCLES WOULD YOU LIKE  '
     212       1 '(5000 IS MAX) ?')
     213        READ(*,625) NCYC
     214    625 FORMAT(I10)
     215        IF ( ( NCYC  GT  5000 )  OR  ( NCYC  LT  1 ) ) GOTO 640
     216        CYCLES=NCYC
     217        DIS=0
     218        WRITE(*,660)
     219    660 FORMAT(/1X,'DO YOU WANT THE RESULTS IN DISCOUNTED DOLLARS (Y N)?')
     220        READ(*,1250) ANS
     221        IF ( ( ANS  EQ  'Y' )  OR  ( ANS  EQ  'y' ) ) DIS=1
     222        IF(DIS  EQ  0 ) GOTO 673
     223        WRITE(*,670)
     224    670 FORMAT(/1X,'WHAT LOT WILL DISCOUNTING BEGIN ?')
     225        READ(*,625) IDF
     226    673 WRITE(*,674)
     227    674 FORMAT(/1X,'THE FOLLOWING OUTPUT MODES ARE AVAILABLE'/5X,'(1) '
     228       + 'OUTPUT TO THE CRT'/5X,'(2) OUTPUT TO THE LINE PRINTER '
     229       +/1X,'SELECT DESIRED OUTPUT MODE (1 2)?')
     230    675 READ(*,625) ID
     231        IF(ID LT 1  OR  ID GT 2) GOTO 673
     232        IF (ID EQ 1) DEV = 0
     233        IF(ID EQ 2) DEV = 1
     234    678 FORMAT(/1X,'COMPUTING RESULTS NOW!')
     235        WRITE (* 678)
     236    680 CALL RREAD(NLN)
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
     237 C***************************
     238 C*
     239 C* COMPUTE TRANGULAR DISTRIBUTION CUMULATIVE PROBABILITY THRESHOLD VALUE
     240 C* FOR USE IN GENERATING DESIRED VARIABLE VALUES FROM A RANDOM  NUMBER
     241 C* IF THE MIN, ML, AND MAX VALUES ARE EQUAL SKIP THE CALCULATION
     242
     243 C*
     244 C*******************************
     245    700 RN=RANDOM(IX)
     246        CIPT=CIP(3)
     247        CISST=CISS(3)
     248        BPT=BP(3)
     249        BSST=BSS(3)
     250        IF(CIP(1) NE CIP(3)) CIPT=(CIP(2)-CIP(1))/(CIP(3)-CIP( 1))
     251        IF(CISS(1) NE CISS(3)) CISST=(CISS(2)-CISS(1))/(CISS( 3)-CISS(1))
     252        IF(BP(1) NE BP(3)) BPT=(BP(2)-BP(1))/(BP(3)-BP(1))
     253        IF(BSS(1) NE BSS(3)) BSST=(BSS(2)-BSS(1))/(BSS(3)-BSS( 1))
     254        DO 780 I=1,NLOT
1    255        CWP(I)=0
1    256        SFPT(I)=SFP(I,3)
1    257        IF(SFP(I,1) EQ SFP(I,3)) GO TO 750
1    258        SFPT(I)=(SFP(I,2)-SFP(I,1))/(SFP(I,3)-SFP(I,1))
1    259    750 SFSST(I)=SFSS(I,3)
1    260        IF(SFSS(I,1) EQ SFSS(I,3)) GO TO 760
1    261        SFSST(I)=(SFSS(I,2)-SFSS(I,1))/(SFSS(I,3)-SFSS(I,1))
1    262    760 ROTPT(I)=ROTP(I,3)
1    263        IF(ROTP(I,1) EQ ROTP(I,3)) GO TO 770
1    264        ROTPT(I)=(ROTP(I,2)-ROTP(I,1))/(ROTP(I,3)-ROTP(I,1))
1    265    770 ROTSST(I)=ROTSS(I,3)
1    266        IF(ROTSS(I,1) EQ ROTSS(I,3)) GO TO 780
1    267        ROTSST(I)=(ROTSS(I,2)-ROTSS(I,1))/(ROTSS(I,3)-ROTSS( I,1))
1    268    780 CONTINUE
     269 C***************************
     270 C*
     271 C* BEGIN THE SIMULATION ----------
     272 C*
     273 C* GENERATE A FIRST UNIT COST AND PERFORMANCE CURVE SLOPE FOR THE PRIME
     274 C* AND SECOND SOURCE SUPPLIERS
     275 C*
     276 C***************************
     277        DO 910 I=1,NCYC
1    278        PFUC=CIP(3)
1    279        SSFUC=CISS(3)
1    280        PB=BP(3)
1    281        SSB=BSS(3)
1    282        IF(CIP(1) EQ CIP(3)) GO TO 790
1    283        RN=RANDOM(IX)
1    284        IF(RN GE CIPT) PFUC=CIP(3)-DSQRT((1-RN)*(CIP(3)-CIP(1))*
1    285       +(CIP(3)-CIP(2)))
1    286        IF(RN LT CIPT) PFUC=CIP(1)+DSQRT(RN*(CIP(3)-CIP(1))*
1    287       +(CIP(2)-CIP(1)))
1    288    790 IF(CISS(1) EQ CISS(3)) GO TO 800
1    289        RN=RANDOM(IX)
1    290        IF(RN GE CISST) SSFUC=CISS(3)-DSQRT((1-RN)*(CISS(3)-CISS( 1))*
1    291       +(CISS(3)-CISS(2)))
1    292        IF(RN LT CISST) SSFUC=CISS(1)+DSQRT(RN*(CISS(3)-CISS( 1))*
1    293       +(CISS(2)-CISS(1)))
1    294    800 IF(BP(1) EQ BP(3)) GO TO 810
1    295        RN=RANDOM(IX)
```

```
D Line# 1      7
1    296        IF(RN GE BPT) PB=BP(3)-DSQRT((1-RN)*(BP(3)-BP(1))*
1    297       +(BP(3)-BP(2)))
1    298        IF(RN LT BPT) PB=BP(1)+DSQRT(RN*(BP(3)-BP(1))*
1    299       +(BP(2)-BP(1)))
1    300    810 IF(BSS(1) EQ BSS(3)) GO TO 820
1    301        RN=RANDOM(IX)
1    302        IF(RN GE BSST) SSB=BSS(3)-DSQRT((1-RN)*(BSS(3)-BSS(1) )*
1    303       +(BSS(3)-BSS(2)))
1    304        IF(RN LT BSST) SSB=BSS(1)+DSQRT(RN*(BSS(3)-BSS(1))*
1    305       +(BSS(2)-BSS(1)))
1    306    820 SCOST(I)=0
1    307        PPCOST=0
1    308        SSCOST=0
1    309        QPC=0
1    310        QSSC=0
1    311        PAVG=0
1    312        SAVG=0
1    313 C**************************
1    314 C*
1    315 C* CALCULATE FIRST UNIT COST AND SLOPE ADJUSTMENT FOR LOT  N DURING THE
1    316 C* GIVEN SIMULATION CYCLE
1    317 C*
1    318 C**************************
1    319        DO 910 J=1,NLOT
2    320        PSF=SFP(J,3)
2    321        IF(SFP(J,1) EQ SFP(J,3)) GO TO 830
2    322        RN=RANDOM(IX)
2    323        IF(RN GE SFPT(J)) PSF=SFP(J,3)-DSQRT((1-RN)*(SFP(J,3) -SFP(J,1))*
2    324       +(SFP(J,3)-SFP(J,2)))
2    325        IF(RN LT SFPT(J)) PSF=SFP(J,1)+DSQRT(RN*(SFP(J,3)-SFP( J,1))*
2    326       +(SFP(J,2)-SFP(J,1)))
2    327    830 SSSF=SFSS(J,3)
2    328        IF(SFSS(J,1) EQ SFSS(J 3)) GO TO 840
2    329        RN=RANDOM(IX)
2    330        IF(RN GE SFSST(J)) SSSF=SFSS(J,3)-DSQRT((1-RN)*
2    331       +(SFSS(J,3)-SFSS(J,1))*(SFSS(J,3)-SFSS(J,2)))
2    332        IF(RN LT SFSST(J)) SSSF=SFSS(J,1)+DSQRT(RN*(SFSS(J,3) -SFSS(J,1))*
2    333       +(SFSS(J,2)-SFSS(J,1)))
2    334    840 PROT=ROTP(J,3)
2    335        IF(ROTP(J,1) EQ ROTP(J,3)) GO TO 850
2    336        RN=RANDOM(IX)
2    337        IF(RN GE ROTPT(J)) PROT=ROTP(J,3)-DSQRT((1-RN)*
2    338       +(ROTP(J,3)-ROTP(J,1))*(ROTP(J,3)-ROTP(J,2)))
2    339        IF(RN LT ROTPT(J)) PROT=ROTP(J,1)+DSQRT(RN*
2    340       +(ROTP(J,3)-ROTP(J,1))*(ROTP(J,2)-ROTP(J,1)))
2    341    850 SSROT=ROTSS(J,3)
2    342        IF(ROTSS(J,1) EQ ROTSS(J,3)) GO TO 860
2    343        RN=RANDOM(IX)
2    344        IF(RN GE ROTSST(J)) SSROT=ROTSS(J,3)-DSQRT((1-RN)*
2    345       +(ROTSS(J,3)-ROTSS(J,1))*(ROTSS(J,3)-ROTSS(J,2)))
2    346        IF(RN LT ROTSST(J)) SSROT=ROTSS(J,1)+DSQRT(RN*
2    347       +(ROTSS(J,3)-ROTSS(J 1))*(ROTSS(J 2)-ROTSS(J,1)))
2    348 C**************************
2    349 C*
2    350 C* BASED ON THE RUNNING UNIT AVG  COST FOR EACH SOURCE  DETERMINE WHICH
2    351 C* SOURCE WILL WIN THE MAJOR SPLIT QUANTITY WHEN SPLIT BUYS ARE BEING
2    352 C* USED   USING THE SELECTED QUANTITTIES  CALCULATE LOT COSTS FOR EACH
2    353 C* SOURCE   INCREMENT RUNNING CUM  COSTS AND UPDATE UNIT AVG  COSTS
2    354 C* CONTINUE UNTIL ALL LOTS HAVE BEEN EVALUATED FOR THE GIVEN SIM
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
2    355 C*
2    356 C**************************
2    357    860 IF(QPC EQ 0 ) GO TO 870
2    358        BBP=ALOG(PB)/ALOG(2 )
2    359        PUCOST=PFUC*QPC**BBP
2    360        IF(QSSC EQ 0 ) GO TO 870
2    361        BBS=ALOG(SSB)/ALOG(2 )
2    362        SUCOST=SSFUC*QSSC**BBS
2    363    870 QP=QM(J)
2    364        QSS=QP
2    365 C*
2    366 C*
2    367 C* IF QM AND QS ARE EQUAL, A COMPOSITE PERFORMANCE CURVE IS  BEING USED
2    368 C* THEREFORE BYPASS THE LOT SPLIT PROCESS
2    369 C*
2    370 C*
2    371        IF(QS(J) EQ QM(J)) GO TO 890
2    372        PAVG=PAVG* PSF
2    373        SAVG=SAVG*SSSF
2    374        IF(SAVG EQ 0 ) GO TO 880
2    375        IF(SAVG LT PAVG) QP=QS(J)
2    376 C*************************************************************************
2    377 C* The following line of code may be used in an alternate single-source
2    378 C* baseline strategy. It guarantees that the second source is ignored
2    379 C* Use it only when the input data implies there is no split award
2    380 C* i e . only in a no-competition. prime-source-only situation
2    381 C*     IF(QS(J) EQ 0 ) QP=QM(J)
2    382 C*************************************************************************
2    383 C*
2    384 C*
2    385 C* DECISION RULE   FOR SPLIT BUY AWARDS THE SOURCE HAVING THE LOWEST AVG
2    386 C* PRICE AS OF THIS LOT FOR A GIVEN SIMULATION CYCLE IS GIVEN THE MAJOR
2    387 C* SPLIT QUANTITY
2    388 C*
2    389 C*
2    390    880 QSS=QM(J)+QS(J)-QP
2    391    890 IF(QP EQ QM(J)) CWP(J)=CWP(J)+1
2    392        PB=ABS(PB-PROT)
2    393        BBP=ALOG(PB)/ALOG(2 )
2    394        IF(QPC NE 0 ) PFUC=PUCOST/(QPC**BBP)
2    395        IF(PSF  NE  1 )PFUC=PFUC*PSF
2    396        BBP=BBP+1
2    397        SSB=ABS(SSB-SSROT)
2    398        IF(SSB NE 0 ) BBS=ALOG(SSB)/ALOG(2 )
2    399        IF(QSSC NE 0 ) SSFUC=SUCOST/(QSSC**BBS)
2    400        IF (SSSF  NE  1 ) SSFUC=SSFUC*SSSF
2    401        BBS=BBS+1
2    402        Q1P=QPC
2    403        Q2P=QPC+QP
2    404        Q1S=QSSC
2    405        Q2S=QSSC+QSS
2    406        QPC=Q2P
2    407        QSSC=Q2S
2    408        DF=1
2    409        IF(DIS EQ 0 ) GO TO 900
2    410        IF(J LT IDF) GO TO 900
2    411        IJ=J-IDF+1
2    412        DF=DISC(IJ)
2    413    900 YP=DF*PFUC*((Q2P+ 5)**BBP-(Q1P+ 5)**BBP)/BBP
```

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D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
2    414       YS=DF*SSFUC*((Q2S+ 5)**BBS-(Q1S+ 5)**BBS)/BBS
2    415 C*
2    416 C*
2    417 C* IF QM AND QS ARE EQUAL  A COMPOSITE PERFORMANCE CURVE IS  BEING USED
2    418 C* THEREFORE THE LOT COST FOR EACH SOURCE IS EQUAL
2    419 C*
2    420 C*
2    421       IF(QS(J) EQ QM(J)) YS=YP
2    422       SCOST(I)=SCOST(I)+YP+YS
2    423       PPCOST=PPCOST+YP
2    424       SSCOST=SSCOST+YS
2    425       PAVG=PPCOST/Q2P
2    426       IF(Q2S NE 0 ) SAVG=SSCOST/Q2S
2    427       ACLOT(J)=ACLOT(J)+(YP+YS)/CYCLES
2    428       ALUC(J)=ALUC(J)+(YP+YS)/(CYCLES*(QM(J)+QS(J)))
2    429       IF(QP NE 0 ) APUCL(J)=APUCL(J)+YP/QP
2    430       IF(QSS NE 0 ) ASUCL(J)=ASUCL(J)+YS/QSS
2    431   910 CONTINUE
     432 C*
     433 C*
     434 C* COMPUTE THE AVERAGE UNIT COST FOR EACH SOURCE AT LOT N   THIS PROCESS
     435 C* REQUIRED SINCE A BUYOUT PERIOD CHANGES THE NUMBER OF CYCLES  A GIVEN
     436 C* SOURCE WILL APPEAR IN A GIVEN SIMULATION RUN DUE TO THE  AWARD RULE
     437 C*
     438 C*
     439       DO 920 I=1 NLOT
1    440       DP=CYCLES
1    441       DS=CYCLES
1    442       IF(QS(I) EQ 0 ) DS=CYCLES-CWP(I)
1    443       IF(QS(I) EQ 0 ) DP=CWP(I)
1    444       IF(DS EQ 0 ) DS=CYCLES
1    445       IF(DP EQ 0 ) DP = CYCLES
1    446       APUCL(I)=APUCL(I)/DP
1    447       ASUCL(I)=ASUCL(I)/DS
1    448   920 CONTINUE
     449 C**************************
     450 C*
     451 C* SORT THE SIMULATION RESULTS AND COMPUTE THE CLASS INTERVAL  SIZE ---
     452 C* (MAX - MIN)/50 ----  ALSO COMPUTE THE AVERAGE COST AND DETERMINE THE
     453 C* MEDIAN COST
     454 C*
     455 C**************************
     456       N=NCYC
     457   930 ICK=0
     458       N=N-1
     459       IF(N EQ 1) GO TO 960
     460       DO 950 I=1,N
1    461       IF(SCOST(I) GE SCOST(I+1)) GO TO 950
1    462   940 HOLD=SCOST(I)
1    463       SCOST(I)=SCOST(I+1)
1    464       SCOST(I+1)=HOLD
1    465       ICK=1
1    466   950 CONTINUE
     467       IF(ICK GT 0) GO TO 930
     468   960 FINC=(SCOST(1)-SCOST(NCYC))/50
     469       IF (FINC  GT   1) GO TO 965
     470       PDF=0
     471       PCF=0
     472       WRITE(DEV 963) SCOST(1)
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
     473    963 FORMAT(1X,'DETERMINISTIC RUN MIN COST=MAX COST=',F11 0)
     474        AVG=SCOST(1)
     475        AMID=SCOST(1)
     476        GO TO 992
     477    965 ICK=NCYC/2+1
     478        AMID=SCOST(ICK)
     479        DO 970 I=1,50
1    480        PCOST(I)=0
1    481    970 CONTINUE
     482        AVG=0
     483        DO 980 I=1,NCYC
1    484        AVG=AVG+SCOST(I)/CYCLES
1    485        J=((SCOST(I)-SCOST(NCYC))/FINC)+1
1    486        IF(J GT 50) J=50
1    487        PCOST(J)=PCOST(J)+1
1    488    980 CONTINUE
     489        DO 990 I=1,50
1    490        PCOST(I)=PCOST(I)/CYCLES
1    491    990 CONTINUE
     492    992 DO 1000 I=1,50
1    493        PV(I)=' '
1    494   1000 CONTINUE
     495        LC=1
     496        IPAGE=0
     497        WRITE(DEV,1010)
     498   1010 FORMAT(1H1)
     499        CALL PAGE(IPAGE,LC,TCK,DEV)
     500        WRITE(DEV,1115)
     501   1115 FORMAT(10X,'ARMY PROCUREMENT RESEARCH OFFICE (APRO)',//,1X,
     502       +'MICROCOMPUTER VERSION OF COMPETITION DECISION ASSIST PACKAGE'//)
     503        LC=LC+4
     504        IF(DIS EQ 0 ) GO TO 1050
     505        WRITE(DEV,1020) IDF
     506        LC=LC+3
     507   1020 FORMAT(/17X,'--- RESULTS ARE IN DISCOUNTED DOLLARS ---',
     508       +/15X,'( 10% )  BEGINNING WITH LOT NUMBER ', I2 )
     509   1050 WRITE(DEV,1060) AVG,AMID
     510        LC = LC + 4
     511   1060 FORMAT(/20X,'***** AVERAGE COST = ',F11 0,' *****'/
     512       +/20X,'*****  MEDIAN COST = ',F11 0,' *****')
     513        WRITE (DEV,1070) SCOST(1), SCOST(NCYC)
     514        LC = LC + 4
     515   1070 FORMAT(/20X,'***** MAXIMUM COST = ',F11 0,' *****'/
     516       +/20X,'***** MINIMUM COST = ',F11 0,' *****')
     517        WRITE(DEV,1075) SCOST(1) - SCOST(NCYC)
     518        LC = LC + 2
     519   1075 FORMAT(/20X,'*****          RANGE = ',F11 0,' *****')
     520        IFORTH = NCYC/4
     521        WRITE (DEV,1076)SCOST(NCYC-IFORTH),SCOST(1+IFORTH)
     522   1076 FORMAT(/20X,'***** FOURTH-SPREAD  ',F11 0,' *****',
     523       +/20X,'*****',16X,F11 0,' *****')
     524        LC = LC + 5
     525        IF(DEV EQ 0) PAUSE
     526        IF(DIS EQ 1 ) WRITE(DEV,1020) IDF
     527        IF(DIS EQ 1) LC=LC+3
     528        IF (TCK EQ 1) WRITE(*,'(1X,2A)')CH,'[2J'
     529        CALL HEAD1(DEV)
     530        LC=LC+5
     531        DO 1100 I=1,NLOT
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
1    532       TICK=' '
1    533       IF(DIS EQ 0 )GO TO 1080
1    534       IF(I GE IDF) TICK='*'
1    535  1080 CWP(I)=CWP(I)/CYCLES*100
1    536       TOTAL=QM(I)+QS(I)
1    537       WRITE(DEV,1090) I,CWP(I),TOTAL,ACLOT(I),TICK,APUCL(I)  TICK,
1    538      +ASUCL(I),TICK,ALUC(I),TICK
1    539  1090 FORMAT(2X,I2,3X,F6.2,4X,I7,4X,F11.0,A1,1X,F7.0,A1,4X,
1    540      +F7.0,A1,5X,F7.0,A1)
1    541       LC=LC+1
1    542       IF(LC LT 57) GOTO 1100
1    543       IF(LC LT 63)GO TO 1100
1    544       CALL ENDP(LC,TCK,ITT,DEV)
1    545       CALL PAGE(IPAGE,LC,TCK,DEV)
1    546       CALL HEAD1(DEV)
1    547       LC=LC+5
1    548  1100 CONTINUE
     549       TOTAL=QPC+QSSC
     550       WRITE(DEV,1110) TOTAL
     551       IF (TCK.EQ.1) WRITE(*,'(1X,2A)') CH,'[2J'
     552       LC=LC+2
     553       IF(LC LT 52) GOTO 1150
     554       IF(LC LT 56) GO TO 1150
     555       CALL ENDP(LC,TCK,ITT,DEV)
     556  1105 CALL PAGE(IPAGE,LC,TCK,DEV)
     557  1110 FORMAT(//1X,'TOTAL NUMBER OF UNITS = ',I7)
     558  1120 FORMAT(//)
     559  1150 LC=LC+4
     560       WRITE(DEV,1120)
     561  1160 FORMAT(//1X,'DATA USED IN RUN---> ',2A6,2X,A8,2X,
     562      +/1X,79('*'))
     563       IF(DEV.EQ.0) PAUSE
     564       WRITE(DEV,1170) CIP
     565       LC=LC+1
     566       IF(LC LT 57) GOTO 1175
     567       IF(LC LT 63) GO TO 1175
     568       CALL ENDP(LC,TCK,ITT,DEV)
     569       CALL PAGE(IPAGE,LC,TCK,DEV)
     570  1170 FORMAT(//1X,'PRIME FIRST UNIT COST--MIN)',F8.0,2X,'MOST  LIKELY)',
     571      +F8.0,2X,'MAX)',F8.0)
     572  1175 WRITE(DEV,1180) CISS
     573       LC=LC+1
     574       IF(LC LT 57) GOTO 1185
     575       IF(LC LT 63) GO TO 1185
     576       CALL ENDP(LC,TCK,ITT,DEV)
     577       CALL PAGE(IPAGE,LC,TCK,DEV)
     578  1180 FORMAT(1X,'SECOND SOURCE----------MIN)',F8.0,2X,'MOST  LIKELY)',
     579      +F8.0,2X,'MAX)',F8.0)
     580  1185 WRITE(DEV,1190) BP
     581       LC=LC+1
     582       IF(LC LT 59) GOTO 1195
     583       IF(LC LT 63) GO TO 1195
     584       CALL ENDP(LC,TCK,ITT,DEV)
     585       CALL PAGE(IPAGE,LC,TCK,DEV)
     586  1190 FORMAT(1X,'PRIME PCURVE SLOPE-----MIN)',1X,F5.3,4X,'MOST LIKELY)'
     587      +,1X,F5.3,4X,'MAX)',1X,F5.3)
     588  1195 WRITE(DEV,1200) BSS
     589       LC=LC+1
     590       IF(LC LT 57) GOTO 1205
```

```
     591       IF(LC LT 63) GO TO 1205
     592       CALL ENDP(LC,TCK,ITT,DEV)
     593       CALL PAGE(IPAGE,LC,TCK,DEV)
     594  1200 FORMAT(1X,'SECOND SOURCE----------MIN)',1X,F5.3,4X,' MOST LIKELY)'
     595      +1X,F5.3,4X,'MAX)',1X,F5.3)
     596  1205 WRITE(DEV,1210) NCYC
     597       IF (TCK EQ 1) WRITE(*,'(1X,2A\)')CH,'[2J'
     598       LC=LC+1
     599       IF(LC LT 52) GOTO 1215
     600       IF(LC LT 56) GO TO 1215
     601       CALL ENDP(LC,TCK,ITT,DEV)
     602       CALL PAGE(IPAGE,LC,TCK,DEV)
     603  1210 FORMAT(1X,'NUMBER OF CYCLES---) ',I4)
     604  1215 CALL HEAD2(DEV)
     605       LC=LC+5
     606       DO 1240 I=1,NLOT
1    607       WRITE(DEV,1230) I,QM(I),QS(I),(SFP(I,J),J=1,3),(SFSS(I,J),J=1,3),
1    608      +(ROTP(I,J),J=1,3),(ROTSS(I,J),J=1,3)
1    609       LC=LC+1
1    610       IF(LC LT 57) GOTO 1240
1    611       IF(LC LT 63) GO TO 1240
1    612       IF(I EQ NLOT) GO TO 1240
1    613       IF (TCK EQ 1) WRITE(*,'(1X,2A\)')CH,'[2J'
1    614       CALL ENDP(LC,TCK,ITT,DEV)
1    615       CALL PAGE(IPAGE,LC,TCK,DEV)
1    616       CALL HEAD2(DEV)
1    617       LC=LC+5
1    618  1230 FORMAT(1X,I2,1X,F5.0,1X,F5.0,12(1X,F4.2))
1    619  1240 CONTINUE
     620       IF (TCK EQ 1) WRITE(*,'(1X,2A\)')CH,'[2J'
     621       CALL ENDP(LC,TCK,ITT,DEV)
     622       IF(DEV EQ 0) PAUSE
     623 C**************************
     624 C*
     625 C* IF SELECTED GENERATE A CUMULATIVE PROBABILITY PLOT
     626 C*
     627 C**************************
     628       IF(PCF EQ 0 ) GO TO 1246
     629       CALL PAGE(IPAGE,LC,TCK,DEV)
     630       WRITE(DEV,1245)
     631       SF=10
     632       CALL SCALE(SF,DEV)
     633       CALL LINE(DEV)
     634       CUM=1
     635       CALL PLOTA(SF,CUM,NCYC,FINC,DEV)
     636       CALL LINE(DEV)
     637       CALL SCALE(SF,DEV)
     638       IF (DEV NE 1) WRITE(DEV,1245)
     639  1245 FORMAT(1X,'STRATEGY COST',18X,'CUMULATIVE PROBABILITY' )
     640       LC=LC+57
     641       IF (TCK EQ 1) WRITE(*,'(1X,2A\)')CH,'[2J'
     642       IF(DEV EQ 0) PAUSE
     643       CALL ENDP(LC,TCK,ITT,DEV)
     644  1246 IF(PDF EQ 0) GO TO 1248
     645       CALL PAGE(IPAGE,LC,TCK,DEV)
     646 C**************************
     647 C*
     648 C* IF SELECTED GENERATE A PROBABILITY DENSITY PLOT
     649 C*
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
    650 C**************************
    651       CUM=0
    652       SF=100
    653       WRITE(DEV,1247)
    654       CALL SCALE(SF,DEV)
    655       CALL LINE(DEV)
    656       CALL PLOTA(SF,CUM,NCYC,FINC,DEV)
    657       CALL LINE(DEV)
    658       CALL SCALE(SF,DEV)
    659       WRITE(DEV,1247)
    660  1247 FORMAT(1X,'STRATEGY COST',24X,'PROBABILITY')
    661       LC=LC+57
    662       IF (TCK.EQ.1) WRITE(*,'(1X,2A\)')CH,'[2J'
    663       CALL ENDP(LC,TCK,ITT,DEV)
    664       IF(DEV.EQ.0) PAUSE
    665  1248 IPAGE='E'
    666       CALL PAGE(IPAGE,LC,TCK,DEV)
    667       WRITE(*,1249)
    668  1249 FORMAT(//,1X,'ANOTHER RUN (Y,N) ? ')
    669       READ(*,1250) ANS
    670  1250 FORMAT(A1)
    671       DEV = 0
    672       IF ( ( ANS .EQ. 'Y' ) .OR. ( ANS .EQ. 'y' ) ) GOTO 570
    673       GO TO 550
    674  1255 WRITE (*,1256)
    675  1256 FORMAT(/1X,'CDAP FINISHED  --  GOOD DAY!')
    676       STOP
    677       END

Name    Type         Offset P Class

ABS                          INTRINSIC
ACLOT   REAL*8         2992  /RD     /
ALOG                         INTRINSIC
ALUC    REAL*8         3192  /RD     /
AMID    REAL           2462
ANS     CHAR*1         1362
APUCL   REAL*8         3392  /RD     /
ASUCL   REAL*8         3592  /RD     /
AVG     REAL*8         2454
BBP     REAL           2308
BBS     REAL           2316
BP      REAL*8          144  /RD     /
BPT     REAL           2140
BSS     REAL*8          168  /RD     /
BSST    REAL           2144
CH      CHAR*1         1118
CHAR                         INTRINSIC
CIP     REAL*8           96  /RD     /
CIPT    REAL           2132
CISS    REAL*8          120  /RD     /
CISST   REAL           2136
COST    REAL*8        *****
CUM     REAL           3704
CWP     REAL*8          802
CYCLES  REAL           1802
DEV     INTEGER*4      1120
DF      REAL           2348
DIS     REAL           1806
```

DISC	REAL	1002	
DP	REAL	2376	
DS	REAL	2380	
DSQRT			INTRINSIC
FID	REAL*8	0	/RD /
FINC	REAL	2400	
FNAME	CHAR*12	3792	/RD /
HOLD	REAL	2396	
I	INTEGER*4	1572	
ICK	INTEGER*4	2388	
ID	INTEGER*4	2084	
IDAY	INTEGER*2	3812	/RD /
IDF	INTEGER*4	1912	
IFORTH	INTEGER*4	2976	
IJ	INTEGER*4	2352	
IMONTH	INTEGER*2	3810	/RD /
IPAGE	INTEGER*4	2474	
ITT	INTEGER*4	1114	
IX	REAL*8	1564	
IY	INTEGER*4	1560	
IYEAR	INTEGER*2	3808	/RD /
J	INTEGER*4	2252	
LC	INTEGER*4	2470	
M1	INTEGER*4	1102	
M2	INTEGER*4	1106	
M3	INTEGER*4	1110	
N	INTEGER*4	2384	
NCYC	INTEGER*4	1792	
NLN	INTEGER*4	2120	
NLOT	INTEGER*4	3804	/RD /
OPN	LOGICAL*4	*****	
PAVG	REAL*8	2236	
PB	REAL	2172	
PCF	REAL	1592	
PCOST	REAL*8	408	/A /
PDF	REAL	1588	
PFUC	REAL*8	2156	
PPCOST	REAL*8	2212	
PROT	REAL	2284	
PSF	REAL	2260	
PUCOST	REAL	2312	
PV	REAL*8	0	/A /
Q1P	REAL	2332	
Q1S	REAL	2340	
Q2P	REAL	2336	
Q2S	REAL	2344	
QM	REAL*8	192	/RD /
QP	REAL	2324	
QPC	REAL	2228	
QS	REAL*8	392	/RD /
QSS	REAL	2328	
QSSC	REAL	2232	
RANDOM	REAL*8		FUNCTION
RN	REAL	1576	
ROTP	REAL*8	1792	/RD /
ROTPT	REAL*8	602	
ROTSS	REAL*8	2392	/RD /
ROTSST	REAL*8	402	
SAVG	REAL*8	2244	

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
SCOST   REAL*8          808    /A      /
SF      REAL           3700
SFP     REAL*8          592    /RD     /
SFPT    REAL*8          202
SFSS    REAL*8         1192    /RD     /
SFSST   REAL*8            2
SHOW    LOGICAL*4     *****
SSB     REAL           2176
SSCOST  REAL*8         2220
SSFUC   REAL*8         2164
SSROT   REAL           2296
SSSF    REAL           2272
SUCOST  REAL           2320
TCK     INTEGER*4      2484
TICK    CHAR*1         3076
TOTAL   INTEGER*4      3078
YP      REAL*8         2356
YS      REAL*8         2364


    678 C*****************************
    679 C*
    680 C* THIS RANDOM(IX) FUNCTION GENERATES A UNIFORM RANDOM NUMBER
    681 C* BETWEEN 0 0 AND 1 0
    682 C* THE RANDOM NUMBER GENERATOR IS BASED ON DRAND(IX) GIVEN IN
    683 C* 'SIMULATION MODELING AND ANALYSIS' BY LAW AND KELTON
    684 C*
    685 C*****************************
    686       DOUBLE PRECISION FUNCTION RANDOM(IX)
    687       DOUBLE PRECISION A,P,IX,B15,B16,XHI,XALO,LEFTLO,FHI,K
    688       DATA A/16807 D0/,B15/32768 D0/,B16/65536 D0/P/2147483647 D0/
    689       XHI=IX/B16
    690       XHI=XHI-DMOD(XHI,1 D0)
    691       XALO=(IX-XHI*B16)*A
    692       LEFTLO=XALO/B16
    693       LEFTLO=LEFTLO-DMOD(LEFTLO,1 D0)
    694       FHI=XHI*A+LEFTLO
    695       K=FHI/B15
    696       K=K-DMOD(K,1 D0)
    697       IX=(((XALO-LEFTLO*B16)-P)+(FHI-K*B15)*B16)+K
    698       IF(IX LT 0 D0)IX=IX+P
    699       RANDOM=IX*4 656612875D-10
    700       RETURN
    701       END

Name    Type         Offset P Class

A       REAL*8         3872
B15     REAL*8         3880
B16     REAL*8         3888
DMOD                         INTRINSIC
FHI     REAL*8         3928
IX      REAL*8            0 *
K       REAL*8         3936
LEFTLO  REAL*8         3920
P       REAL*8         3896
XALO    REAL*8         3912
XHI     REAL*8         3904
    702 C*****************************
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2.00
     703 C*
     704 C* SCALE ----- ARGUMENT IS THE SCALE FACTOR TO BE USED IN  LABELING THE
     705 C*              PLOT AND LATER CALCULATING PLOT POINTS.
     706 C*
     707 C****************************
     708        SUBROUTINE SCALE(SF,IDEV)
     709        DIMENSION D(10)
     710        DO 1260 I=1,10
1    711        D(I)=I/SF
1    712  1260 CONTINUE
     713        WRITE(IDEV,1270) D
     714  1270 FORMAT(15X,'0.00',10(1X,F4.2))
     715        RETURN
     716        END

Name    Type         Offset P Class

D       REAL           3944
I       INTEGER*4      3984
IDEV    INTEGER*4         4 *
SF      REAL              0 *


     717 C****************************
     718 C*
     719 C* LINE ----- THIS SUBROUTINE SIMPLY LAYS OUT THE REFERENCE  MARKS FOR
     720 C*              SELECTED SCALE
     721 C*
     722 C****************************
     723        SUBROUTINE LINE(IDEV)
     724        WRITE(IDEV,1280)
     725  1280 FORMAT(16X,'+',10('----+'))
     726        RETURN
     727        END

Name    Type         Offset P Class

IDEV    INTEGER*4         0 *


     728 C****************************
     729 C*
     730 C* PLOTA ----- ARGUMENTS ARE THE SCALE FACTOR, SELECTION PARAMETER  FOR
     731 C*              CUMULATIVE OR DENSITY PLOT(CUM),  VALUE  OF THE
     732 C*              NUMBER OF SIMULATION CYCLES(NCYC), AND CLASS  INTERVAL
     733 C*              VALUE(FINC)
     734 C*
     735 C****************************
     736        SUBROUTINE PLOTA(SF,CUM,NCYC,FINC,IDEV)
     737        REAL*8 PV,PCOST,SCOST
     738        COMMON/A/PV(51),PCOST(50),SCOST(5000)
     739        DIMENSION AV(51)
     740        CHARACTER AV
     741        COST=SCOST(NCYC)
     742        VAL=0
     743        DO 1290 I=1,50
1    744        AV(I)=' '
1    745  1290 CONTINUE
     746        WRITE(IDEV,1320) COST,(AV(J),J=1,50),VAL
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
     747        COST=COST-FINC/2
     748        DO 1330 I=1,50
1    749        IF(CUM.EQ 0 ) VAL=PCOST(I)
1    750        IF(CUM.EQ 1 ) VAL=VAL+PCOST(I)
1    751        IVAL=VAL*5 *SF+ 5
1    752        IF(IVAL GT 51)IVAL=51
1    753        DO 1300 J=1,IVAL
2    754        AV(J)='*'
2    755   1300 CONTINUE
1    756        IVAL=IVAL+1
1    757        DO 1310 J=IVAL,50
2    758        AV(J)=' '
2    759   1310 CONTINUE
1    760        COST=COST+FINC
1    761        WRITE(IDEV,1320) COST,(AV(J),J=1,50),VAL
1    762   1320 FORMAT(4X,F11 0,1X,'|',50A1,2X,F6 4)
1    763   1325 FORMAT(4X,F11 0,1X,'|',50A1,2X,F6 4)
1    764   1330 CONTINUE
     765        RETURN
     766        END

Name    Type         Offset P Class

AV      CHAR*1         4034
COST    REAL           4086
CUM     REAL              4 *
FINC    REAL             12 *
I       INTEGER*4      4094
IDEV    INTEGER*4        16 *
IVAL    INTEGER*4      4106
J       INTEGER*4      4098
NCYC    INTEGER*4         8 *
PCOST   REAL*8          408    /A      /
PV      REAL*8            0    /A      /
SCOST   REAL*8          808    /A      /
SF      REAL              0 *
VAL     REAL           4090


     767 C**************************
     768 C*
     769 C* RREAD ----- ARGUMENT IS THE FILE NAME LENGTH  THIS SUBROUTINE
     770 C*              READS THE SELECTED DATA FILE FOR THOSE PROGRAM MODES THAT
     771 C*              USE AN EXISTING FILE
     772 C*
     773 C**************************
     774        SUBROUTINE RREAD(NLN)
     775        COMMON/RD/FID(12),CIP(3),CISS(3),BP(3),BSS(3),QM(25),
     776       +QS(25),SFP(25,3),SFSS(25,3),ROTP(25,3),ROTSS(25,3),ACLOT(25),
     777       +ALUC(25),APUCL(25),ASUCL(25),FNAME,NLOT,IYEAR,IMONTH,IDAY
     778        REAL*8 FID,CIP,CISS,BP,BSS,QM,QS,SFP,SFSS,ROTP,ROTSS, ACLOT,
     779       + ALUC,APUCL,ASUCL
     780        CHARACTER*12 FNAME,DUMMY
     781        INTEGER*2 IYEAR,IMONTH,IDAY
     782        CALL GETFILE( FNAME  3 )
     783        READ(3,1350,END=1415)NLOT
     784   1350 FORMAT(5X,I2)
     785        READ(3,1360) CIP
     786   1360 FORMAT(29X,F8 0,14X,F8 0,6X,F8 0)
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2.00
     787        READ(3,1360) CISS
     788        READ(3,1370) BP
     789  1370 FORMAT(29X,F5.3,17X,F5.3,9X,F5.3)
     790        READ(3,1370) BSS
     791        DO 1390 I=1,4
1    792        READ(3,1380) DUMMY
1    793  1380 FORMAT(A12)
1    794  1390 CONTINUE
     795        DO 1410 I=1,NLOT
1    796        READ(3,1400,END=1415)QM(I),QS(I),(SFP(I,J),J=1,3),(SFSS(I,J),
1    797       +J=1,3),(ROTP(I,J),J=1,3),(ROTSS(I,J),J=1,3)
1    798  1400 FORMAT(3X,F5.0,1X,F5.0,12(1X,F4.2))
1    799        ACLOT(I)=0
1    800        ALUC(I)=0
1    801        APUCL(I)=0
1    802        ASUCL(I)=0
1    803  1410 CONTINUE
     804  1415 CLOSE(3)
     805        RETURN
     806        END

Name    Type         Offset P Class

ACLOT   REAL*8         2992   /RD    /
ALUC    REAL*8         3192   /RD    /
APUCL   REAL*8         3392   /RD    /
ASUCL   REAL*8         3592   /RD    /
BP      REAL*8          144   /RD    /
BSS     REAL*8          168   /RD    /
CIP     REAL*8           96   /RD    /
CISS    REAL*8          120   /RD    /
DUMMY   CHAR*12        4246
FID     REAL*8            0   /RD    /
FNAME   CHAR*12        3792   /RD    /
I       INTEGER*4      4242
IDAY    INTEGER*2      3812   /RD    /
IMONTH  INTEGER*2      3810   /RD    /
IYEAR   INTEGER*2      3808   /RD    /
J       INTEGER*4      4268
NLN     INTEGER*4         0 *
NLOT    INTEGER*4      3804   /RD    /
QM      REAL*8          192   /RD    /
QS      REAL*8          392   /RD    /
ROTP    REAL*8         1792   /RD    /
ROTSS   REAL*8         2392   /RD    /
SFP     REAL*8          592   /RD    /
SFSS    REAL*8         1192   /RD    /


     807 C**************************
     808 C*
     809 C* CREATE ---- THIS SUBROUTINE IS USED TO CREATE A NEW DATA FILE
     810 C*              REMOVAL OF FILES IS HANDLED WHILE IN THE OPERATING
     811 C*              SYSTEM COMMAND MODE   ARGUMENTS REPRESENT ENTRY
     812 C*              POINTS WHEN CALLED FROM *MODIFY   M1 SETS THE
     813 C*              BASIC ENTRY. M2 IS THE STARTING LOT NUMBER. AND M3
     814 C*              IS THE ENDING LOT NUMBER
     815 C*
     816 C**************************
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
     817       SUBROUTINE CREATE(M1,M2,M3)
     818       COMMON/RD/FID(12),CIP(3),CISS(3),BP(3),BSS(3),QM(25),
     819      +QS(25),SFP(25,3),SFSS(25,3),ROTP(25,3),ROTSS(25,3),ACLOT(25),
     820      +ALUC(25),APUCL(25),ASUCL(25),FNAME,NLOT,IYEAR,IMONTH,IDAY
     821       REAL*8 PV,PCOST,SCOST,FID,CIP,CISS,ACLOT,ALUC,BP,BSS, SFP,SFSS,
     822      +ROTP,ROTSS,SFPT(25),SFSST(25),ROTPT(25),ROTSST(25),QM, QS,CWP(25)
     823      +,AVG,COST,PPCOST,SSCOST,PAVG,SAVG,YP,YS,SSFUC, PFUC,ASUCL,APUCL
     824       REAL DISC(25)
     825       CHARACTER*12 FNAME,ANS
     826       INTEGER*2 IYEAR,IMONTH,IDAY
     827       LOGICAL OPN
     828       IF(M1 EQ 1)GO TO 1555
     829       IF(M1 EQ 2)GO TO 1495
     830       IF(M1 EQ 3)GO TO 1525
     831       IF(M1 EQ 4)GO TO 1535
     832       IF(M1 EQ 5)GO TO 1545
     833       IF(M1 EQ 6)GO TO 1555
     834  1420 WRITE(*,1430)
     835  1430 FORMAT(/1X,'WHAT IS THE DATA FILE NAME')
     836       READ(*,1440) FNAME
     837       WRITE(*,1445) FNAME
     838  1440 FORMAT(A12)
     839  1445 FORMAT(1X 'THE DATA FILE NAME IS    ',A12)
     840  1448 FORMAT(I2)
     841  1450 FORMAT(F8 0)
     842  1485 WRITE(*,1490)
     843  1490 FORMAT(/1X,'HOW MANY LOTS ARE THERE IN THIS DATA SET ?')
     844       READ(*,1448)NLOT
     845       M2=1
     846       M3=NLOT
     847  1493 IF (M1  EQ  1) RETURN
     848  1495 WRITE(*,1500)
     849  1500 FORMAT(/1X,'FIRST UNIT COST FOR PRIME'/1X,'MINIMUM    ')
     850       READ(*,1450)CIP(1)
     851       WRITE(*,1510)
     852  1510 FORMAT(/1X,'MOST LIKELY   ')
     853       READ(*,1450)CIP(2)
     854       WRITE(*,1520)
     855  1520 FORMAT(/1X,'MAXIMUM    ')
     856       READ(*,1450)CIP(3)
     857       IF(M1 EQ 2)RETURN
     858  1525 WRITE(*,1530)
     859  1530 FORMAT(/1X,'SECOND SOURCE FIRST UNIT COST'/1X,'MINIMUM    ')
     860       READ(*,1450)CISS(1)
     861       WRITE(*,1510)
     862       READ(*,1450)CISS(2)
     863       WRITE(*,1520)
     864       READ(*,1450)CISS(3)
     865       IF(M1 EQ 3)RETURN
     866  1535 WRITE(*,1540)
     867  1540 FORMAT(/1X,'PRIME PERFORMANCE CURVE SLOPE ( XXX)'/1X
     868      + 'MINIMUM  ')
     869       READ(*,1450)BP(1)
     870       WRITE(*,1510)
     871       READ(*,1450)BP(2)
     872       WRITE(*,1520)
     873       READ(*,1450)BP(3)
     874       IF(M1 EQ 4)RETURN
     875  1545 WRITE(*,1550)
```

```
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     876  1550 FORMAT(/1X,'SECOND SOURCE PERFORMANCE CURVE SLOPE ( XXX)'/
     877      + 1X,'MINIMUM  ')
     878       READ(*,1450)BSS(1)
     879       WRITE(*,1510)
     880       READ(*,1450)BSS(2)
     881       WRITE(*,1520)
     882       READ(*,1450)BSS(3)
     883       IF(M1 EQ 5)RETURN
     884  1555 DO 1620 I=M2,M3
1    885       WRITE(*,1560)I
1    886  1560 FORMAT(/1X,'DATA FOR LOT # ',I2/1X,'MAJOR SPLIT QUANTITY')
1    887       READ(*,1450)QM(I)
1    888       WRITE(*,1570)
1    889  1570 FORMAT(/1X,'MINOR SPLIT QUANTITY')
1    890       READ(*,1450)QS(I)
1    891       WRITE(*,1580)
1    892  1580 FORMAT(/1X,'PRIME SHIFT FACTOR ( XXX)'/1X,'MINIMUM  ')
1    893       READ(*,1450)SFP(I,1)
1    894       WRITE(*,1510)
1    895       READ(*,1450)SFP(I,2)
1    896       WRITE(*,1520)
1    897       READ(*,1450)SFP(I,3)
1    898       WRITE(*,1590)
1    899  1590 FORMAT(/1X,'SECOND SOURCE SHIFT FACTOR ( XXX)'/1X,'MINIMUM  ')
1    900       READ(*,1450)SFSS(I,1)
1    901       WRITE(*,1510)
1    902       READ(*,1450)SFSS(I,2)
1    903       WRITE(*,1520)
1    904       READ(*,1450)SFSS(I,3)
1    905       WRITE(*,1600)
1    906  1600 FORMAT(/1X,'PRIME ROTATION FACTOR ( XXX)'/1X,'MINIMUM  ')
1    907       READ(*,1450)ROTP(I,1)
1    908       WRITE(*,1510)
1    909       READ(*,1450)ROTP(I,2)
1    910       WRITE(*,1520)
1    911       READ(*,1450)ROTP(I,3)
1    912       WRITE(*,1610)
1    913  1610 FORMAT(/1X,'SECOND SOURCE ROTATION FACTOR ( XXX)'/1X,
1    914      + 'MINIMUM  ')
1    915       READ(*,1450)ROTSS(I,1)
1    916       WRITE(*,1510)
1    917       READ(*,1450)ROTSS(I,2)
1    918       WRITE(*,1520)
1    919       READ(*,1450)ROTSS(I,3)
1    920  1620 CONTINUE
     921       IF(M1 EQ 1)RETURN
     922       IF(M1 EQ 6)RETURN
     923       CALL RWRITE
     924       WRITE(*,1630)
     925  1630 FORMAT(//1X,'ANOTHER FILE (Y,N) ? ')
     926       READ(*,1640)ANS
     927  1640 FORMAT(A1)
     928       IF ( ( ANS  EQ  'Y' )  OR  ( ANS  EQ  'y' ) ) GOTO 1420
     929       RETURN
     930       END

  Name    Type         Offset P Class

  ACLOT   REAL*8         2992   /RD     /
```

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ALUC	REAL*8	3192	/RD	/
ANS	CHAR*12	6205		
APUCL	REAL*8	3392	/RD	/
ASUCL	REAL*8	3592	/RD	/
AVG	REAL*8	*****		
BP	REAL*8	144	/RD	/
BSS	REAL*8	168	/RD	/
CIP	REAL*8	96	/RD	/
CISS	REAL*8	120	/RD	/
COST	REAL*8	*****		
CWP	REAL*8	5118		
DISC	REAL	5318		
FID	REAL*8	0	/RD	/
FNAME	CHAR*12	3792	/RD	/
I	INTEGER*4	5856		
IDAY	INTEGER*2	3812	/RD	/
IMONTH	INTEGER*2	3810	/RD	/
IYEAR	INTEGER*2	3808	/RD	/
M1	INTEGER*4	0 *		
M2	INTEGER*4	4 *		
M3	INTEGER*4	8 *		
NLOT	INTEGER*4	3804	/RD	/
OPN	LOGICAL*4	*****		
PAVG	REAL*8	*****		
PCOST	REAL*8	*****		
PFUC	REAL*8	*****		
PPCOST	REAL*8	*****		
PV	REAL*8	*****		
QM	REAL*8	192	/RD	/
QS	REAL*8	392	/RD	/
ROTP	REAL*8	1792	/RD	/
ROTPT	REAL*8	4918		
ROTSS	REAL*8	2392	/RD	/
ROTSST	REAL*8	4718		
SAVG	REAL*8	*****		
SCOST	REAL*8	*****		
SFP	REAL*8	592	/RD	/
SFPT	REAL*8	4518		
SFSS	REAL*8	1192	/RD	/
SFSST	REAL*8	4318		
SSCOST	REAL*8	*****		
SSFUC	REAL*8	*****		
YP	REAL*8	*****		
YS	REAL*8	*****		

```
      C*****************************
      C*
      C*  RWRITE ------ THIS SUBROUTINE WRITES DATA IN TO A PERMANENT FILE
      C*                 IT IS USED BY *CREATE AND *MODIFY
      C*
      C*****************************
            SUBROUTINE RWRITE
            COMMON/RD/FID(12),CIP(3),CISS(3),BP(3),BSS(3),QM(25),
           +QS(25),SFP(25,3),SFSS(25,3),ROTP(25,3),ROTSS(25,3),ACLOT(25)
           +ALUC(25),APUCL(25),ASUCL(25),FNAME,NLOT,IYEAR,IMONTH,IDAY
            REAL*8 PV,PCOST,SCOST,FID,CIP,CISS,ACLOT,ALUC,BP,BSS,SFP,SFSS
           +ROTP,ROTSS,SFPT(25),SFSST(25),ROTPT(25),ROTSST(25),QM,QS,CWP(25)
           +,AVG,COST,PPCOST,SSCOST,PAVG,SAVG,YP,YS,SSFUC,PFUC,ASUCL,APUCL
```

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```
     944        CHARACTER*12 FNAME
     945        INTEGER*2 IYEAR,IMONTH,IDAY
     946        REAL DISC(25)
     947        CALL MAKEFILE( FNAME, 2 )
     948        WRITE(2,1650)NLOT
     949  1650 FORMAT('ID : ',I2)
     950        WRITE(2,1660) (CIP(J),J=1,3)
     951  1660 FORMAT(' PRIME FIRST UNIT COST---MIN)',F8.0,2X,'MOST LIKELY)'
     952       + F8.0,2X,'MAX)',F8.0)
     953        WRITE(2,1670)(CISS(J),J=1,3)
     954  1670 FORMAT(' SECOND SOURCE----------MIN)',F8.0,2X,'MOST LIKELY)'
     955       + F8.0,2X,'MAX)',F8.0)
     956        WRITE(2,1680)(BP(J),J=1,3)
     957  1680 FORMAT(' PRIME PCURVE SLOPE------MIN)',F5.3,5X,'MOST LIKELY)'
     958       + F5.3,5X,'MAX)',F5.3)
     959        WRITE(2,1690)(BSS(J),J=1,3)
     960  1690 FORMAT(' SECOND SOURCE----------MIN)',F5.3,5X,'MOST LIKELY)'
     961       + F5.3,5X,'MAX)',F5.3)
     962        WRITE(2,1700)
     963  1700 FORMAT(//' LOT LOT QUAN  SHIFT FACTOR',3X,'SHIFT FACTOR',3X,
     964       + 'ROTATION FACT',2X,'ROTATION FACT'/1X,'#',16X,'PRIME',7X,
     965       + 'SECOND SOURCE',5X,'PRIME',7X,'SECOND SOURCE'/5X,'MAX MIN',
     966       + 2X,4('MIN  M L  MAX  '))
     967        DO 1720 I=1,NLOT
1    968        WRITE(2,1710) I,QM(I),QS(I),(SFP(I,J),J=1,3),(SFSS(I,J),J=1,3),
1    969       + (ROTP(I,J),J=1,3),(ROTSS(I,J),J=1,3)
1    970  1710 FORMAT(I2,1X,F5.0,1X,F5.0,12(1X,F4.2))
1    971  1720 CONTINUE
     972        CLOSE(2)
     973        RETURN
     974        END
```

Name	Type	Offset	P	Class
ACLOT	REAL*8	2992	/RD	/
ALUC	REAL*8	3192	/RD	/
APUCL	REAL*8	3392	/RD	/
ASUCL	REAL*8	3592	/RD	/
AVG	REAL*8	*****		
BP	REAL*8	144	/RD	/
BSS	REAL*8	168	/RD	/
CIP	REAL*8	96	/RD	/
CISS	REAL*8	120	/RD	/
COST	REAL*8	*****		
CWP	REAL*8	7022		
DISC	REAL	7222		
FID	REAL*8	0	/RD	/
FNAME	CHAR*12	3792	/RD	/
I	INTEGER*4	7888		
IDAY	INTEGER*2	3812	/RD	/
IMONTH	INTEGER*2	3810	/RD	/
IYEAR	INTEGER*2	3808	/RD	/
J	INTEGER*4	7334		
NLOT	INTEGER*4	3804	/RD	/
PAVG	REAL*8	*****		
PCOST	REAL*8	*****		
PFUC	REAL*8	*****		
PPCOST	REAL*8	*****		
PV	REAL*8	*****		

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```
QM       REAL*8          192    /RD     /
QS       REAL*8          392    /RD     /
ROTP     REAL*8         1792    /RD     /
ROTPT    REAL*8         6822
ROTSS    REAL*8         2392    /RD     /
ROTSST   REAL*8         6622
SAVG     REAL*8        *****
SCOST    REAL*8        *****
SFP      REAL*8          592    /RD     /
SFPT     REAL*8         6422
SFSS     REAL*8         1192    /RD     /
SFSST    REAL*8         6222
SSCOST   REAL*8        *****
SSFUC    REAL*8        *****
YP       REAL*8        *****
YS       REAL*8        *****


  975 C*****************************
  976 C*
  977 C* MODIFY-----THIS SUBROUTINE ALLOWS MODIFICATION OF AN EXISTING DATA
  978 C*              FILE, WHEN CALLED THE CURRENT DATA IS DISPLAYED ALONG
  979 C*              WITH LOCATOR REFERENCES   A GIVEN DATA ELEMENT CAN BE
  980 C*              MODIFIED BY ENTERING THE LOCATOR WHICH WILL CAUSE THE
  981 C*              APPROPRIATE PROMPT TO BE GIVEN   THIS ROUTINE WILL ALSO
  982 C*              ALLOW THE LOT NUMBER TO BE EXPANDED WITH CORRESPONDING
  983 C*              INPUT PROMPTS FOR THE EXPANDED LOT DATA   IF THE LOT
  984 C*              NUMBER IS REDUCED EXISTING DATA WILL BE RETAINED AND
  985 C*              SIMPLY IGNORED WHEN THE SIMULATION IS RUN
  986 C*
  987 C*****************************
  988       SUBROUTINE MODIFY
  989       COMMON/RD/FID(12),CIP(3),CISS(3),BP(3),BSS(3),QM(25),
  990      +QS(25),SFP(25,3),SFSS(25,3),ROTP(25,3),ROTSS(25,3),ACLOT(25),
  991      +ALUC(25),APUCL(25),ASUCL(25),FNAME,NLOT,IYEAR,IMONTH,IDAY
  992       REAL*8 PV,PCOST,SCOST,FID,CIP,CISS,ACLOT,ALUC,BP,BSS, SFP,SFSS,
  993      +ROTP,ROTSS,SFPT(25),SFSST(25),ROTPT(25),ROTSST(25),QM, QS,CWP(25)
  994      +,AVG,COST,PPCOST,SSCOST,PAVG,SAVG YP,YS,SSFUC, PFUC,ASUCL,APUCL
  995       CHARACTER*12 FNAME,ANS
  996       INTEGER*2 IYEAR,IMONTH,IDAY
  997       REAL DISC(25)
  998  1730 WRITE(*,1740)
  999  1740 FORMAT(/1X,'WHAT IS THE NAME OF THE FILE YOU WISH TO MODIFY')
 1000       READ(*,1750) FNAME
 1001  1750 FORMAT(A12)
 1002  1770 CALL RREAD(NLN)
 1003       NLOTP=NLOT+1
 1004       WRITE(*,1780)NLOT
 1005  1780 FORMAT(//1X,'(1) NUMBER OF LOTS    ',I2)
 1006       WRITE(*,1790) (CIP(J),J=1,3)
 1007  1790 FORMAT(1X,'(2) PRIME FIRST UNIT COST-MIN)',F8 0,2X,'MOST LIKELY)
 1008      +,F8 0,2X,'MAX)',F8 0)
 1009       WRITE(*,1800)(CISS(J) J=1 3)
 1010  1800 FORMAT(' (3) SECOND SOURCE---------MIN)' F8 0 2X,'MOST LIKELY)
 1011      + F8 0 2X 'MAX)' F8 0)
 1012       WRITE(*,1810)(BP(J),J=1 3)
 1013  1810 FORMAT(' (4) PRIME PCURVE SLOPE----MIN)'F5 3 5X 'MOST LIKELY)
 1014      + F5 3,5X,'MAX)' F5 3)
 1015       WRITE(* 1920)(BSS(J) J=1 3)
```

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```
    1016  1820 FORMAT(' (5) SECOND SOURCE---------MIN',F5 3,5X,'MOST LIKELY)',
    1017      + F5 3,5X,'MAX)',F5 3)
    1018       WRITE(* 1830)
    1019       WRITE(*,1835)
    1020       WRITE(*,1837)
    1021  1830 FORMAT(' (6)'/' LOT  LOT QUAN  SHIFT FACTOR',3X,'SHIFT FACTOR',3X,
    1022      + 'ROTATION FACT',2X,'ROTATION FACT')
    1023  1835  FORMAT(1X,'#',16X,'PRIME',7X,
    1024      + 'SECOND SOURCE',5X,'PRIME',7X,'SECOND SOURCE')
    1025  1837  FORMAT(4X,'MAX  MIN',
    1026      + 2X,4('MIN  M L  MAX  '))
    1027       DO 1850 I=1,NLOT
 1  1028       WRITE(* 1840) I,QM(I),QS(I),(SFP(I,J),J=1,3),(SFSS(I,J),J=1,3),
 1  1029      + (ROTP(I J),J=1,3),(ROTSS(I,J),J=1,3)
 1  1030  1840 FORMAT(I2,1X,F5 0,1X,F5 0,12(1X,F4 2))
 1  1031  1850 CONTINUE
    1032  1860 WRITE(*,1870)
    1033  1870 FORMAT(//1X,'ENTER THE NUMBER IN THE ( ) THAT ',
    1034      + 'CORRESPONDS'/1X,'TO THE LINE YOU WANT TO MODIFY ',
    1035      + /1X, 'A ZERO (0) ABORTS MODIFICATION ')
    1036  1875 FORMAT(I6)
    1037       READ(*,1875)LINE
    1038       if ( line  EQ  0 ) return
    1039       IF ( ( LINE  LT  1 )  OR  ( LINE  GT  6 ) ) GOTO 1860
    1040       IF(LINE NE 1)GO TO 1890
    1041       WRITE(*,1880)
    1042  1880 FORMAT(/1X,'PLEASE INPUT THE NEW NUMBER OF LOTS')
    1043       READ(*,1875)NLOTM
    1044       IF(NLOTM GT NLOT)CALL CREATE(LINE,NLOTP,NLOTM)
    1045       NLOT=NLOTM
    1046       GO TO 1920
    1047  1890 IF(LINE NE 6)GO TO 1910
    1048       WRITE(*,1900)
    1049  1900 FORMAT(/1X,'WHAT LOT NUMBER DO YOU WANT TO MODIFY')
    1050       READ(*,1875)LOTN
    1051       CALL CREATE(LINE,LOTN,LOTN)
    1052       GO TO 1920
    1053  1910 CALL CREATE(LINE,NLOT,NLOT)
    1054  1920 WRITE(*,1930)
    1055  1930 FORMAT(///1X,'ANY MORE CHANGES (Y,N) ?')
    1056       READ(*,1940)ANS
    1057  1940 FORMAT(A1)
    1058       IF ( ( ANS  EQ  'Y' )  OR  ( ANS  EQ  'y' ) ) GOTO 1860
    1059       CALL RWRITE
    1060 C**** M1=0
    1061 C**** M2=0
    1062 C**** M3=0
    1063       RETURN
    1064       END
```

Name	Type	Offset	P	Class
ACLOT	REAL*8	2992	/RD	/
ALUC	REAL*8	3192	/RD	/
ANS	CHAR*12	10129		
APUCL	REAL*8	3392	/RD	/
ASUCL	REAL*8	3592	/RD	/
AVG	REAL*8	*****		
BP	REAL*8	144	/RD	/

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BSS	REAL*8	168	/RD	/
CIP	REAL*8	96	/RD	/
CISS	REAL*8	120	/RD	/
COST	REAL*8	*****		
CWP	REAL*8	8740		
DISC	REAL	8940		
FID	REAL*8	0	/RD	/
FNAME	CHAR*12	3792	/RD	/
I	INTEGER*4	9768		
IDAY	INTEGER*2	3812	/RD	/
IMONTH	INTEGER*2	3810	/RD	/
IYEAR	INTEGER*2	3808	/RD	/
J	INTEGER*4	9144		
LINE	INTEGER*4	9992		
LOTN	INTEGER*4	10090		
NLN	INTEGER*4	9102		
NLOT	INTEGER*4	3804	/RD	/
NLOTM	INTEGER*4	10040		
NLOTP	INTEGER*4	9106		
PAVG	REAL*8	*****		
PCOST	REAL*8	*****		
PFUC	REAL*8	*****		
PPCOST	REAL*8	*****		
PV	REAL*8	*****		
QM	REAL*8	192	/RD	/
QS	REAL*8	392	/RD	/
ROTP	REAL*8	1792	/RD	/
ROTPT	REAL*8	8540		
ROTSS	REAL*8	2392	/RD	/
ROTSST	REAL*8	8340		
SAVG	REAL*8	*****		
SCOST	REAL*8	*****		
SFP	REAL*8	592	/RD	/
SFPT	REAL*8	8140		
SFSS	REAL*8	1192	/RD	/
SFSST	REAL*8	7940		
SSCOST	REAL*8	*****		
SSFUC	REAL*8	*****		
YP	REAL*8	*****		
YS	REAL*8	*****		

```
1065 C*************************************
1066 C*
1067 C* PAGE-------------THIS SUBROUTINE KEEPS TRACK OF INDIVIDUAL OUTPUT
1068 C*                  PAGES   THE ARGUMENT IS THE RUNNING PAGE NUMBER AND
1069 C*                  LINE COUNT
1070 C*
1071 C*************************************
1072       SUBROUTINE PAGE(IPAGE,LC,TCK,IDEV)
1073       COMMON/RD/FID(12),CIP(3),CISS(3),BP(3),BSS(3),QM(25)
1074      +QS(25),SFP(25,3),SFSS(25,3),ROTP(25,3),ROTSS(25,3),ACLOT(25,
1075      +ALUC(25),APUCL(25),ASUCL(25),FNAME,NLOT,IYEAR,IMONTH,IDAY
1076       REAL*8 PV,PCOST,SCOST,FID,CIP,CISS,ACLOT,ALUC,BP,BSS,SFP,SFSS
1077      +ROTP,ROTSS,SFPT(25),SFSST(25),ROTPT(25),ROTSST(25),QM,QS,CWP,DS
1078      +,AVG,COST,PPCOST,SSCOST,PAVG,SAVG,YP,YS,SSFUC,PFUC,ASUCL,APUCL
1079       CHARACTER*12 FNAME
1080       INTEGER*2 IYEAR,IMONTH,IDAY
1081       IF (TCK .EQ. 1) GOTO 2005
```

```
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    1082        WRITE(IDEV,2000)
    1083  2000  FORMAT(79(1H-))
    1084  2005  IF(IPAGE.EQ.'E')RETURN
    1085        IPAGE=IPAGE+1
    1086        LC=2
    1087  2006  FORMAT(1H,A6)
    1088        WRITE(IDEV,2010) IMONTH,IDAY,IYEAR,IPAGE
    1089  2010  FORMAT(1X,'RUN DATE (MO/DY/YR) ---)    ',I2,'/',I2,'/',I4,
    1090       +10X'PAGE ',I2)
    1091        IF (IPAGE GT 1) GOTO 2015
    1092        WRITE (IDEV,2013)
    1093  2013  FORMAT(//)
    1094        LC = LC + 2
    1095  2015  RETURN
    1096        END
```

Name	Type	Offset	P	Class
ACLOT	REAL*8	2992		/RD /
ALUC	REAL*8	3192		/RD /
APUCL	REAL*8	3392		/RD /
ASUCL	REAL*8	3592		/RD /
AVC	REAL*8	*****		
BP	REAL*8	144		/RD /
BSS	REAL*8	168		/RD /
CIP	REAL*8	96		/RD /
CISS	REAL*8	120		/RD /
COST	REAL*8	*****		
CWP	REAL*8	10946		
FID	REAL*8	0		/RD /
FNAME	CHAR*12	3792		/RD /
IDAY	INTEGER*2	3812		/RD /
IDEV	INTEGER*4	12	*	
IMONTH	INTEGER*2	3810		/RD /
IPAGE	INTEGER*4	0	*	
IYEAR	INTEGER*2	3808		/RD /
LC	INTEGER*4	4	*	
NLOT	INTEGER*4	3804		/RD /
PAVC	REAL*8	*****		
PCOST	REAL*8	*****		
PFUC	REAL*8	*****		
PPCOST	REAL*8	*****		
PV	REAL*8	*****		
QM	REAL*8	192		/RD /
QS	REAL*8	392		/RD /
ROTP	REAL*8	1792		/RD /
ROTPT	REAL*8	10746		
ROTSS	REAL*8	2392		/RD /
ROTSST	REAL*8	10546		
SAVC	REAL*8	*****		
SCOST	REAL*8	*****		
SFP	REAL*8	592		/RD /
SFPT	REAL*8	10346		
SFSS	REAL*8	1192		/RD /
SFSST	REAL*8	10146		
SSCOST	REAL*8	*****		
SSFUC	REAL*8	*****		
TCK	REAL	8	*	
YP	REAL*8	*****		

```
1097 C************************
1098 C*
1099 C* HEAD1----------THIS SUBROUTINE PRINTS THE HEADING ASSOCIATED WITH
1100 C*                SIMULATION LOT DATA RESULTS   IT IS CALLED WHENEVER
1101 C*                A PAGE BREAK OCCURS IN THE GIVEN PORTION OF THE
1102 C*                OUTPUT
1103 C*
1104 C************************
1105       SUBROUTINE HEAD1(IDEV)
1106       WRITE(IDEV,2020)
1107  2020 FORMAT(//1X,'PRIME SPLIT WIN',32X,'AVERAGE UNIT COSTS'/1X,
1108      + 'PERCENTAGE',17X,'AVERAGE LOT',2X,'-----------------------',
1109      + '----------'/1X,'LOT #',3X,'%',5X,'LOT QUANTITY',5X,'COST',7X,
1110      + 'PRIME',3X,'SECOND SOURCE',2X,'COMPOSITE'/1X,'-----',1X,'------',
1111      + 2X,'------------',2X,'-----------',2X,'-------',2X,
1112      + '-------------',2X,'---------')
1113       RETURN
1114       END

Name   Type         Offset P Class

IDEV   INTEGER*4         0 *


1115 C************************
1116 C*
1117 C* HEAD2----------THIS SUBROUTINE PRINTS THE HEADING ASSOCIATED WITH
1118 C*                THE DATA FILE DISPLAY   IT IS CALLED FOR EACH PAGE
1119 C*                BREAK
1120 C*
1121 C************************
1122       SUBROUTINE HEAD2(IDEV)
1123       WRITE(IDEV,2030)
1124  2030 FORMAT(//16X,'SHIFT FACTOR',3X,'SHIFT FACTOR',3X,'ROTATION FACT',
1125      + 2X,'ROTATION FACT'/1X,'LOT  LOT QUAN',5X,'PRIME',7X,
1126      + 'SECOND SOURCE',5X,'PRIME',7X,'SECOND SOURCE'/2X,'#',3X
1127      + 'MAX  MIN',2X,4('MIN  M L  MAX  ')/1X,'---',1X,'---- ----',
1128      + 4(' ---- ---- ----'))
1129       RETURN
1130       END

Name   Type         Offset P Class

IDEV   INTEGER*4         0 *


1131 C************************
1132 C*
1133 C* ENDP------THIS SUBROUTINE PADS THE BOTTOM OF EACH PAGE WITH BLANK
1134 C*           LINES TO INSURE EACH PAGE IS PRINTED IN 8 1/2 X 11 INCH
1135 C*           FORMAT
1136 C*
1137 C************************
1138       SUBROUTINE ENDP(LC,TCK,ITT,IDEV)
1139       IF (TCK  EQ  0) GOTO 2037
1140       WRITE(IDEV,2035)
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
    1141  2035 FORMAT(1H1)
    1142       RETURN
    1143  2037 LC=LC+1
    1144       DO 2050 I=LC,67 2
 1  1145       WRITE(IDEV,2040)
 1  1146  2040 FORMAT(/)
 1  1147  2050 CONTINUE
    1148       RETURN
    1149       END

 Name   Type         Offset P Class

 I      INTEGER*4     11886
 IDEV   INTEGER*4        12 *
 ITT    INTEGER*4         8 *
 LC     INTEGER*4         0 *
 TCK    REAL              4 *


    1150 C*
    1151 C*
    1152 C*************************************************************************
    1153 C*
    1154 C*
    1155 C*  GetFile ----- This routine is used to open previously existing
    1156 C*       data files   If given a non-existent filename, GetFile will
    1157 C*       prompt for a new filename until it gets an existing file
    1158 C*
    1159 C*       GetFile gets the filename and channel passed as parameters
    1160 C*       rather than through COMMON   It changes the COMMON filename
    1161 C*       DON'T, DON'T, DON'T use it to change channel/unit numbers
    1162 C*
    1163 C*     NOTE   the function FindFile CAN'T use the COMMON filename
    1164 C*
    1165 C*************************************************************************
    1166 C*
    1167 C*
    1168       SUBROUTINE GetFile( filename  channel
    1169        CHARACTER*12 filename
    1170        INTEGER*2 channel
    1171 C*
    1172 C*     local variables
    1173        CHARACTER*12 TempNameString
    1174        INTEGER*2 StringLength  ParseFilename
    1175        LOGICAL*2 FindFile
    1176 C*
    1177 C*     begin
    1178 100    StringLength = ParseFilename  filename
    1179        TempNameString = filename
    1180 C*     if the file exists
    1181        IF   FindFile  StringLength  TempNameSt
    1182        GOTO 200
    1183 C*      then open it
    1184 150    OPEN  channel  FILE =  filename
    1185        RETURN
    1186 C*     else some other error has occurred
    1187 200    WRITE *
    1188 300    FORMAT  ( The f e    A
    1189        WRITE *
```

D Line# 1 7 IBM Personal Computer FORTRAN Compiler V2.00

```
   1190 350     FORMAT( 1X, 'What file would you like to use?' )
   1191         READ( *, 400 ) filename
   1192 400     FORMAT( A12 )
   1193 C*      check to see if this file is legit
   1194         GOTO 100
   1195         END

Name   Type         Offset P Class

CHANNE INTEGER*2         4 *
FILENA CHAR*12           0 *
FINDFI LOGICAL*2             FUNCTION
PARSEF INTEGER*2             FUNCTION
STRING INTEGER*2     11894
TEMPNA CHAR*12       11896


   1196 C*
   1197 C*
   1198 C*************************************************************************
   1199 C*
   1200 C*
   1201 C*    MakeFile ---- This routine is used to create data files
   1202 C*     If the file already exists, MakeFile prompts for
   1203 C*     permission to overwrite the existing file or use
   1204 C*     a different filename
   1205 C*
   1206 C*     Filename and channel number are passed as parameters
   1207 C*     rather than through COMMON   The COMMON filename will
   1208 C*     be changed   DON'T change channel numbers!
   1209 C*
   1210 C*    NOTE   the function FindFile CAN'T use the COMMON filename
   1211 C*
   1212 C*************************************************************************
   1213 C*
   1214 C*
   1215         SUBROUTINE MakeFile( filename, channel )
   1216          CHARACTER*12 filename
   1217          INTEGER*2 channel
   1218 C*
   1219 C*     local variables
   1220          CHARACTER*12 TempNameString
   1221          CHARACTER*1 response
   1222          INTEGER*2 StringLength, ParseFilename
   1223          LOGICAL*2 FindFile
   1224 C*
   1225 C*     begin
   1226 100       StringLength = ParseFilename( filename )
   1227          TempNameString = filename
   1228 C*       if the file exists
   1229          IF ( FindFile( StringLength, TempNameString ) ) GOTO 300
   1230 C*        then ask permission to overwrite it
   1231 C*       else it can be legitimately created
   1232 200      OPEN( channel, FILE = filename, STATUS = 'NEW' )
   1233          RETURN
   1234 C*       given the file exists, ask for permission to overwrite
   1235 300      WRITE( *, 400 ) filename
   1236 400      FORMAT( 1X, 'The file ', A12, ' already exists' )
   1237          WRITE( *, 450 )
```

```
D Line# 1      7                    IBM Personal Computer FORTRAN Compiler V2 00
    1238 450      FORMAT( 1X, 'Do you want to remake it? ( Y or N )' )
    1239          READ( *, 500 ) response
    1240 500      FORMAT( A1 )
    1241 C*       if permission given then recreate the file
    1242          IF ( ( response .EQ. 'Y' ) .OR. ( response .EQ. 'y' ) ) GOTO 200
    1243 C*       else get a new filename
    1244           WRITE( *, 600 )
    1245 600      FORMAT( /1X, 'Type the new filename in ' )
    1246           READ( *, 700 ) filename
    1247 700      FORMAT( A12 )
    1248 C*       check to see if this file is legit
    1249           GOTO 100
    1250         END

 Name    Type         Offset P Class

 CHANNE INTEGER*2          4 *
 FILENA CHAR*12            0 *
 FINDFI LOGICAL*2     *****
 PARSEF INTEGER*2     *****
 RESPON CHAR*1         12165
 STRING INTEGER*2      12058
 TEMPNA CHAR*12        12060


    1251 C*
    1252 C*
    1253 C*************************************************************************
    1254 C*                                                                       *
    1255 C*     ParseFilename scans the FilenameString for blanks to see how      *
    1256 C*     long the string is   DO NOT MODIFY the string, ParseFilename      *
    1257 C*     is effectively EQUIVALENCEing [sic] the filename in COMMON        *
    1258 C*                                                                       *
    1259 C*************************************************************************
    1260 C*
    1261 C*
    1262         INTEGER*2 FUNCTION ParseFilename( FilenameString )
    1263          CHARACTER*1 FilenameString( 12 )
    1264 C*
    1265 C*     local variables
    1266          INTEGER*2 i
    1267          CHARACTER*1 space
    1268 C*
    1269 C*     local constants
    1270          DATA space / ' ' /
    1271 C*
    1272 C* begin
    1273 C*
    1274         DO 100 i = 1, 12
  1 1275 C*      if character is an ascii space,
  1 1276          IF ( FilenameString( i )  NE  space ) GOTO 100
  1 1277 C*                          then end-of-string is found
  1 1278           ParseFilename = i - 1
  1 1279           RETURN
  1 1280 C*       else keep looking
  1 1281 100      CONTINUE
    1282         ParseFilename = 12
    1283 200    RETURN
    1284         END
```

D Line# 1 7 IBM Personal Computer FORTRAN Compiler V2 00

```
Name   Type         Offset P Class

FILENA CHAR*1            0 *
I      INTEGER*2     12322
SPACE  CHAR*1        12320


   1285 C*
   1286 C*
   1287 C*************************************************************************
   1288 C*
   1289 C*      LOGICAL*2 FUNCTION FindFile( StringLength, FilenameString )
   1290 C*      INTEGER*2 Stringlength
   1291 C*      CHARACTER*12 FilenameString
   1292 C*
   1293 C*      is external to this source file because it was written
   1294 C*     in Assembler
   1295 C*
   1296 C*     NOTE   the parameters passed to it CAN'T be in COMMON
   1297 C*
   1298 C*************************************************************************
   1299 C*
   1300 C*

Name   Type           Size   Class

A                    40808  COMMON
CREATE                      SUBROUTINE
ENDP                        SUBROUTINE
FINDFI LOGICAL*2            FUNCTION
GETDAT                      SUBROUTINE
GETFIL                      SUBROUTINE
HEAD1                       SUBROUTINE
HEAD2                       SUBROUTINE
LINE                        SUBROUTINE
MAIN                        PROGRAM
MAKEFI                      SUBROUTINE
MODIFY                      SUBROUTINE
PAGE                        SUBROUTINE
PARSEF INTEGER*2            FUNCTION
PLOTA                       SUBROUTINE
RANDOM REAL*8               FUNCTION
RD                    3814  COMMON
RREAD                       SUBROUTINE
RWRITE                      SUBROUTINE
SCALE                       SUBROUTINE


 Pass One    No Errors Detected
          1300 Source Lines
```

APPENDIX D

CDAPM

TECHNICAL REFERENCE

APPENDIX D

CDAPM TECHNICAL REFERENCE

1. The Competition Decision-Assist Package for the Microcomputer (CDAPM) was written in FORTRAN for the IBM Personal Computer FORTRAN Compiler Version 2.0.

2. To get results as accurate and consistent as possible, CDAPM uses the 8087-math options built into the compiler. Since only a few machines in the field have 8087s or the like, CDAPM will emulate the 8087 when the chip is not there. Emulation costs execution speed, but APRO feels that consistency in CDAPM is more important than speed.

3. CDAPM has been tried out on several different makes of PC; CDAPM works on all the computers it was tried on. APRO does not mean to slight any manufacturer whose computer is not listed below; the machines listed below are simply those that were available around Fort Lee, VA for APRO to use.

Computer	Run Time (1001 Cycles)
IBM PC w/PC-DOS 2.1	44 min.
Wyse 1100-1 PC w/MS-DOS 2.11	43 min.
Compaq Plus w/MS-DOS 2.11	49 min.
Compaq Plus w/MS-DOS 2.11; w/8087	7 min.
Compaq Deskpro w/MS-DOS 3.0	4[illegible] min.
Compaq Deskpro w/MS-DOS 3.0; 8 MHz	23 min.
Tandy 1000 w/MS-DOS 2.1	52 min.
Leading Edge PC w/PC-DOS 2.1	33 min.
Leading Edge PC w/MS-DOS 2.11	30 min.

These are not intended to be definitive benchmarks; in several cases, background processes were running, but these time tests generally show the [illegible] to expect. Users should note the big difference in [illegible] charged" processor chip makes.

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(U) Project Managers must assess the extent to which their system ought to be competed. The objective of this study was to develop, test, and operate a microcomputer version of the Competition Decision-Assist Package (CDAP). CDAPM provides a microcomputer FORTRAN version of CDAP to assist Program Managers in their competition decisions.

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